Options for the Design of Tracking Systems

Work Package 3 report from the E-TRACK project

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Executive Summary

The E-TRACK project develops a proposal for the coordinated and consistent tracking of electricity attributes in Europe. The background for this work is the demand for a synchronised system of allocating the so-called attributes of power generation (fuel source, emissions, support granted etc.) to consumers of energy, for example for purposes of electricity disclosure. However, tracking is also required for many support schemes for electricity generation from renewable energy sources (RES-E) or from high-efficiency cogeneration (CHP-E) as well as for the accounting of cross-border transfers of RES-E for quantitative targets.

Work package 3 of the E-TRACK project focuses on the analysis of different options of the general set-up of tracking systems. This activity was based on an interactive process between the project team and a group of stakeholders, which participated in the Advisory Group of the project as well as in a number of regional consultation workshops. Although the recommendations developed are those of the project team, comments from these stakeholders have been taken into account to the extent possible.

This report starts out with an explanation of some general principles of how tracking could be organised. Firstly, the requirements for tracking are grouped into three generic schemes: disclosure, support and target accounting. Secondly, domains are defined as the geographical entities in which a tracking system for one or several schemes is implemented. Finally, the variants of explicit tracking, which allow for a bilateral allocation of attributes between two parties, and implicit tracking are explained. Implicit tracking relates to the use of a default set of attributes for purposes of disclosure.

Different options for the design of tracking systems have been analysed. For this task, a structured approach using a scenario methodology has been used. As a result, four different tracking options are presented and evaluated based on a set of six criteria. These options describe a reasonable range of tracking systems which have been or could be implemented in Europe. As a result from this discussion, a set of conclusions was derived, which form the basis for the subsequent development of the proposed tracking standard. These conclusions include the following elements:

- Contract-based tracking and de-linked tracking (based on certificates) can be combined in one explicit tracking mechanism based on certificates. If market participants wish to use contract-based tracking, they can re-bundle certificates with contracts.

- Any tracking system should feature at least the two elements 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 certificates held in registries. Guarantees of Origin for RES-E and CHP-E should be integrated into this mechanism.
• Implicit tracking should be based on a residual mix, which corrects generation statistics in a certain region by the attributes, which have been allocated based on explicit tracking, and by exports and imports of electricity and attributes.

The individual elements of tracking under these conclusions are discussed in more detail. This includes an analysis whether all schemes can be facilitated by a single certificate system. The result is a recommendation to allow for the optional separation of support certificates from the Guarantees of Origin, if required by the design of the support system. However, this requires that certain safeguards are taken in order to avoid confusion between support certificates and Guarantees of Origin, and their misunderstanding or misuse. In order to address those tracking systems which already exist, and which might need to coexist with the E-TRACK standard for at least an interim period, the category of External Reliable Tracking Systems is defined and criteria for their acceptance in parallel to the tracking standard are defined. These aim at avoiding multiple counting of attributes due to the parallel existence of tracking systems.

Finally, the procedure for the calculation of the residual mix as the default value for implicit tracking is explained. This formula intends not only to avoid multiple counting in relation to explicit tracking and External Reliable Tracking Systems, but also to ensure a proper reflection of the imports and exports of electricity and attributes.

The elements described in this report constitute the general ingredients for the E-TRACK standard. A more detailed analysis of the technical requirements for such a standard can be found in the E-TRACK work package 4 report (Pooley et al. 2007). The work package 5 report (Ritter et al. 2007) includes an analysis of the costs of tracking systems. Based on these inputs, the final project report (Timpe et al. 2007) then develops the condensed description of the E-TRACK standard and a plan for its implementation.
Glossary

**Association (to a scheme)**
A link to a scheme for which a certificate is eligible. Certificates can have one or more associations.

**Association of Issuing Bodies**
The European organisation which governs the European Energy Certificate System (EECS).

**(Electricity) Attributes**
Information on electricity, which is to be allocated through tracking. Details are specified by the respective schemes. For example for disclosure, the following attributes are required: Fuel source and technology, CO\textsubscript{2} emissions and nuclear waste created.

**Certificate**
An instance of evidence (normally in units related to 1 MWh) for one or more schemes which can be transferred between different owners. Certificates are usually held as electronic records in a database, which is called registry.

**Compliance period**
A period of time which is used for the verification of compliance with a scheme. E.g. for electricity disclosure, the compliance period is one year.

**Contract-based tracking**
An explicit tracking method where electricity attributes are allocated to consumers based on the bilateral contracts concluded in the electricity market. Contract-based tracking can be performed ex ante or ex post (in relation to the point in time when the electricity contract is concluded). In any case, contract-based tracking can be implemented based on certificates, which in this case would be allocated along the contract path.

**De-linked tracking**
An explicit tracking method where electricity attributes are allocated to consumers based on certificates which allow for the allocation of the attributes from generators to consumers along a path which is independent from the physical electricity market.

**(Electricity) Disclosure**
Based on Directive 2003/54/EC electricity retailers must disclose to their customers the origin of their electricity and related CO\textsubscript{2} emissions and the production of nuclear waste. This requires the installation of a tracking system for electricity.
Disclosure certificates
Certificates which can be used for purposes of disclosure, i.e. which are associated to the disclosure scheme. A synonym for Guarantees of Origin in their broader sense.

Domain
A single geographic or geopolitical region defined for the purposes of a scheme. There must be only one scheme authority in a domain.

Electricity from high-efficient cogeneration (CHP-E)
Electricity from high-efficiency cogeneration, as defined in Directive 2004/8/EC.

Electricity from renewable energy sources (RES-E)
Electricity from renewable energy sources as defined in Directive 2001/77/EC.

European Clearing Body
An organisation which coordinates the cross-border aspects of residual mix calculations under the E-TRACK standard.

European Energy Certificate System (EECS)
A harmonised European system for the handling of certificates for electricity attributes, which is operated by the Association of Issuing Bodies. EECS is the only standardised tracking system for electricity in Europe. Currently, EECS integrates Guarantees of Origin for RES-E and CHP-E, RECS certificates and generic disclosure certificates.

Evidence
Proof of a set of generation attributes. Certificates are issued against evidence to facilitate transfers and compliance with schemes.

Explicit tracking
A mechanism which allows the bilateral allocation of electricity attributes from a generator to a retailer or final consumer. This can be based on electricity contracts or de-linked from these. Both types of explicit tracking can be implemented based on certificates.

External Reliable Tracking Systems (ERTS)
Independent explicit tracking systems, e.g. in relation to feed-in support systems, which exist alongside with the E-TRACK standard. In order to avoid multiple counting of attributes in relation to explicit and implicit tracking under the standard, ERTS must fulfil certain criteria.
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Generation episode
A period in time during which electricity was generated, usually marked by two meter readings. Tracking is usually based on the average attributes of electricity generation during a generation episode.

Guarantee of Origin (GO)
In a specific sense: A means of proving the origin of electricity, which was generated from renewable energy sources or from high-efficient cogeneration, which was introduced by Directives 2001/77/EC (for RES-E) and 2004/8/EC (for CHP-E). Their use is optional.
In a broader sense: General term for methods or certificates for explicit tracking.

Implicit tracking
A mechanism which allows the allocation of electricity attributes from a group of generators to usually a large group of retailers or final consumers. The simplest way of implicit tracking is the use of statistical data on electricity generation in a certain area, e.g. national or UCTE or NORDEL system mixes. The E-TRACK standard requires the use of a residual mix instead of production statistics.

Issuing Body
The organisation which is appointed by the scheme authority to manage a tracking domain. The issuing body can delegate several tasks, e.g. to a registry operator, production device accreditation body, data collector (for meter readings etc.).

Multiple counting
The use of attributes from the same instance of electricity generation for more than one uses, which are conflicting. For example, if the attributes of a hydro plant from Austria are used for disclosure both in Austria and in Italy, this is a case of multiple counting. Multiple counting can be distinguished into multiple issuing, multiple sale and multiple use of attributes. The question whether certain uses of attributes are conflicting or not, must be regulated clearly, e.g. by the scheme authorities.

Nordel
The organisation for the Nordic transmission system operators (http://www.nordel.org).

OTC trading
Bilateral trading of standardised electricity contracts, which is not performed on power exchanges.
Physical electricity market
Market transactions (long-term contracts, OTC trade, trade on power exchanges) which imply physical delivery of energy into the balancing group of the buyer. Pure financial contracts can be disregarded, as they do not allocate physical energy.

RECS International
The European organisation of market participants which use the European Energy Certificate System (EECS). RECS International and the AIB have jointly developed the RECS System, which can be seen as a predecessor of Guarantees of Origin for RES-E.

Renewable Energy Certificate System (RECS)
A voluntary scheme which was developed in order to track electricity attributes from RES-E for purposes of green electricity supply. The RECS System can be seen as a predecessor of Guarantees of Origin for RES-E.

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 set of attributes for use in electricity disclosure, which has been determined based on the attributes of all electricity generation in one or several disclosure domains and corrected by all attributes which have been used for explicit tracking or by ERTS, and also for exports and imports of attributes and physical energy. Each residual mix stands for a certain volume of attributes and should not be used for the disclosure of a larger volume of electricity consumption than this volume.

Scheme
A set of rules and procedures using the results from attribute tracking for the purposes of e.g. complying with a Directive, supporting specific generation technologies, or evidencing a quality label for electricity products.

Scheme authority
A person or a body appointed by legislation or by members of a voluntary scheme to control the qualification of production devices and both the issuing, transfer and redemption of certificates for that scheme. Additionally, a scheme authority will manage the compliance process including the use of non-certificate information, e.g. based on the residual mix or ERTS. There must be only one scheme authority for a scheme in any domain.
Support
A policy by which a country promotes the generation of electricity from certain energy sources (e.g. renewable energies) or by certain technologies (e.g. cogeneration) through financial incentives.

Targets
Quantitative targets for certain types of electricity generation which have been set on a European level and have been broken down on the national level. Currently, indicative targets have been set for the shares of RES-E in total electricity consumption of EU Member States by 2010. More ambitious overall targets for renewable energy sources, and possibly also sectoral targets for RES-E, for the year 2020 are currently under discussion. There are currently no clear EU-wide targets for CHP-E.

Tracking
General term for the accounting of generation attributes. It usually implies an allocation of attributes from generators of electricity to consumers or their retailers.

UCTE
Union for the Co-ordination of Transmission of Electricity in continental Europe (http://www.ucte.org).
Introduction

The E-TRACK project has investigated the feasibility of a harmonised standard for tracking of generation attributes in Europe. The aim of the project was to outline a comprehensive approach for all tracking requirements which are imposed by European and national legislation. The major benefits of such a tracking standard will be that electricity attributes (such as the fuel type used for generation and related environmental indicators) can easily be accounted for in the internal market; problems with multiple counting of attributes (e.g. from renewable energy sources) can be avoided; verification of tracking procedures can be simplified and cross-border trade of attributes will be facilitated. The tracking standard has been designed in such a way as to support European and Member State electricity policies. It leaves room for the specific design of tracking systems on the national or regional level and it does not predetermine policy decisions such as the design of support instruments for electricity from renewable energy sources or cogeneration.

The project provides a detailed insight into the requirements for the design and operation of tracking systems, which are set by European and Member States legislation as well as by market participants. The main result of the project is a blueprint of a European standard for tracking of electricity generation attributes, which covers technical aspects (e.g. database and interface specifications) and non-technical issues, such as institutions and processes involved. The project involved partners with scientific expertise as well as electricity transmission system operators, regulators and market players, which will be able to work with the standard. This ensures that results from the project are oriented towards practical implementation and can easily be disseminated. An intensive consultation phase and several dissemination activities have supported the project results.

In the context of the project, the term “standard” is used in an informal way. It denotes a set of rules which can be applied in European countries in order to implement a tracking system. If required, additional national regulations can be added. The standard is not meant as a formal standard, e.g. under CEN or Cenelec rules.

This report

This work package report contains a structured analysis and evaluation of different options for the design of tracking systems. This discussion leads into a set of general, high-level recommendations for the E-TRACK standard. Following on this, the general elements of tracking systems under the standard are discussed, and recommendations for their use under the standard are developed.

The many technical terms, which could not be avoided in order to cover the tracking issue adequately, are explained in a glossary.

This work package is based on the results from earlier work in the project, and at the same time forms the basis for other work packages. All work package reports as well as
the final E-TRACK project report and additional documentation from the consultation workshops and the project conference can be downloaded from the project website: http://www.e-track-project.org.

The project team wishes to thank the numerous stakeholders who participated in the meetings of the project’s Advisory Group, the project conference and in the many consultation workshops which were held across Europe for their valuable contributions and comments. However, the sole responsibility for the results lies with the project team.
1 Objectives and Approach of the Work Package

1.1 Objectives and Methodologies Used

The major objective of the E-TRACK project is to draft a harmonised standard for tracking electricity generation attributes in Europe. Such tracking 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.

The intention of designing a European standard is to allow for certain variations in the implementation of tracking in different domains rather than to enforce one single, fully harmonised tracking system across Europe. This approach is based on the subsidiarity principle and is meant to leave room for the designers of tracking systems to reflect the specific framework conditions for tracking in their domains.

This work package 3 report focuses on the structured analysis of tracking options and develops a set of high-level recommendations for the tracking standard. The analysis is based on a scenario methodology, which uses a set of descriptors for the definition of tracking system options. This approach allows developing a large number of designs for tracking systems. From these, the project team has selected four options which were then analysed and evaluated based on a set of criteria.

The second part of the report contains a detailed discussion of the main elements of tracking systems and recommendations for requirements for these under the E-TRACK standard.

1.2 Overview on the Consultation Process

It was a key objective of the E-TRACK project to involve stakeholders from different parts of Europe in the discussions in the project. This allowed integrating comments from these actors in the design of the proposed standard. By doing this, the project team hoped to increase the actual uptake of recommendations from the project by governments, regulators and the electricity sector. At the same time, the consultations served for an early dissemination of interim results from the project. This was very helpful, as many countries have reviewed their tracking systems in parallel to the project duration, and so the project was able to feed in early recommendations into these processes.

The consultations were performed as a sounding board for all work packages of the project. They included the following elements:

- A high-ranked Advisory Group on the European level, which included representatives from the key stakeholder groups. The Advisory Group was convened for four meetings.
A series of regional consultation workshops, in which the preliminary results from the project were presented and discussed. The series consisted of three workshops:

- In the first workshops, the general approach of the project to the issue of tracking and the related policies were discussed.
- The second round of workshops addressed general options for the design of tracking systems and related evaluation criteria.
- The third set of workshops discussed a preliminary draft of the tracking standard, as well as an analysis of the cost and benefits of tracking systems under the proposed standard.

The final draft of the standard and its background were presented and discussed in a project conference, which took place in Brussels in March 2007.

The final recommendations from the project reflect the comments made by stakeholders to the extent possible. However, it was not always achievable to incorporate all comments, and in some cases there were different views between the stakeholder groups in the consultation process. Obviously, the final responsibility for the recommendations from the project lies with the project team.

A condensed description of the E-TRACK standard and its background can be found in the final report from the project (Timpe et al. 2007).
2 General principles of tracking

Generally, tracking of attributes can not follow the physical flows in the electricity network, because such flows can not be determined in sufficient detail. Even more important, the flows of electrons are determined by physical laws, and do not give a picture about the trading arrangements in the electricity market.

What is needed are mechanisms for the allocation of attributes, which form an abstraction of the physical energy flows. With explicit and implicit tracking, two generic options for tracking can be distinguished.

The following chapters outline some general terms and principles of electricity tracking, which are a basis for the further discussions in this report. For an explanation of the terms used, please see the Glossary.

2.1 Schemes

A scheme represents a certain policy for which results of tracking can be used. 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 standard types of schemes:

- 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.

- Support: Systems for financial support of certain technologies for electricity production, e.g. from renewable energy sources (RES-E) or high-efficient cogeneration (CHP-E) can be based on support certificates or on other mechanisms. (Note that the use of certificates for tracking purposes does not imply a certain preference in the design of support schemes. 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 RES-E by the year 2010. So far, it is not fully clear how compliance with these targets will be measured. Certificate systems can help in monitoring at least the cross-border transfer of RES-E attributes, and potentially also the overall production and consumption of RES-E.

Guarantees of Origin (GO) for electricity from renewable energy sources (RES-E) and electricity from high-efficient cogeneration (CHP-E) have been implemented in EU Member States and other European countries based on EU Directives 2001/77/EC and 2004/8/EC. GO issued in any Member State in accordance with the Directives should be accepted in all other Member States. Although the GO are not formally linked to the disclosure scheme, they can be used 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.

Compared to the three schemes listed above, the European Carbon Emissions Trading system (ETS) is not regarded as a scheme which requires electricity tracking. This is due to the fact that the ETS is an allowance scheme which is upstream of the electricity market, and electricity consumers are not required to deal with the emission allowances themselves. However, there can be synergies with regards to emissions information from the ETS which could be used by the disclosure scheme. It should also be noted that due to the existence of this “cap and trade” system, tracking of attributes in the electricity sector can not bring about actual emissions reductions, but rather allocates the relative emissions under the cap to retailers and consumers of electricity.

The actor, which is responsible for a scheme, is called the scheme authority. It usually sets up details of the scheme, defines all necessary rules and appoints the relevant actors to operate the tracking system for this scheme.

### 2.2 Domains

All schemes which have been addressed in the previous section relate to a certain geographic region. Most schemes are currently implemented on the national level, e.g. disclosure or support systems. In the future some national schemes might be merged in order to create larger systems or markets.

The definition of a geographic region in relation to a scheme is called a domain. All tracking activities are organised in domains. For example, the disclosure scheme in Austria is operated within one domain. The Swedish “Elcert” support system for RES-E represents another domain.

### 2.3 Explicit Tracking

Explicit tracking denotes a mechanism, which uses or creates bilateral links between generation and consumption of electricity. These links do not have to be direct, as it is implied in Figure 1 below, they may be using intermediaries. The links are used in order to allocate the attributes of power generation to consumers (or their retailers).
It is obvious from the figure above that explicit tracking allows for directing the allocation of attributes. Certain consumers can be linked to generation of RES-E, whereas others can be linked to fossil or nuclear generation.

There are two options for explicit tracking:

A) Contract-based tracking

Under this tracking option, electricity generation attributes are allocated to consumers based on the contracts concluded in the electricity market. It must be noted that “contract” in this context refers to contracts which imply physical delivery of energy into the balancing group of the buyer. Pure financial contracts can be disregarded, as they do not allocate physical energy.
There are two options how contract-based tracking can be implemented:

- **A1) Ex-ante specification of attributes**
  
  Under this option, the attributes of power generation are part of the electricity contract, i.e. the seller specifies in the contract, which attributes will be allocated to the buyer. This option might work well in case of generation owned by retailers and bilateral long-term contracts between generators and retailers. However, this option is very difficult to implement in the framework of liquid electricity markets. The reason for this is that in such markets, electricity is seen as a commodity (without attributes) and it is usually traded several times before it is actually produced. In this framework, contract-based tracking of attributes with ex-ante specification would be complex and, even more important, would split up the electricity market into several sub-markets, which would reduce market liquidity. Power exchanges can hardly be integrated in an ex-ante contract-based tracking, because the exchange can only determine the attributes available over a certain trading period after the end of this period.

- **A2) Ex-post determination of attributes**
  
  In this case, the buyer of electricity agrees to receive the company average attribute mix of the seller, but both parties do not know this mix exactly at the time of concluding the contract. The accounting of attributes takes place after the generation and consumption of energy, when the seller can determine his attribute mix based on his own generation and purchases from third parties. He then allocates a volume of this attribute mix to the buyer which is corresponding to the volume of physical energy in the contract.
  
  This option does not have a negative impact on electricity markets, as electricity can still be seen as a commodity. However, this means that this tracking option will only deliver somewhat unsighted tracking results. This is because if electricity is traded as a commodity under this tracking option, then the attributes can not become a relevant factor for the energy market. The buyer will not be able to steer his attribute portfolio in a certain direction, because he does not know the attribute mix of the different sellers at the time of concluding contracts. Therefore this tracking option is only suitable for that part of the market, where active management of attributes is not regarded as relevant.
  
  There is also a practical problem related to this tracking option: Because the electricity market is quite complex and at least part of the electricity is traded back and forth between the market participants, and buyers of energy are often also sellers, a straightforward determination of the company attribute mix of the seller in the case
above might not be possible, as it is depending from the attribute mixes of too many other market participants.\(^1\)

However, the ex-post determination of attributes might work well for integrating power exchanges into a contract-based tracking system, if the trading relationships are not too complex. The exchange can request all net sellers to the exchange to determine their company attribute mix. From this, the exchange would determine an exchange attribute mix over a certain period, e.g. a week or a calendar month. This information could be used by all net buyers from the exchange.

**B) De-linked tracking**

De-linked tracking is using transferable certificates for the allocation of attributes. The certificates are issued based on the volumes and attributes of electricity generation. All existing certificate systems use one or several standardised units of certificate face values; e.g. 1 MWh of electricity generation. The standardisation simplifies the accounting of attributes.

After issuing, they can be transferred independently (de-linked) from the physical energy market. In order to acquire attributes, e.g. for the disclosure scheme, a retailer must purchase certificates which represent attributes of the required electricity volume. The attributes represented in a certificate are used by redeeming the certificate, which is then removed from circulation in the market.

The de-linked tracking option makes the tracking system fully independent from the complexity of the electricity market. Correspondingly, the electricity market is not restricted in its liquidity by the tracking system, as it would be the case in a contract-based tracking scheme with ex-ante specification of attributes.

\(^1\) See chapter 4.5 on a discussion of the related approach which is recommended by the German utility association VDEW
The handling of tracking certificates is usually based on electronic registries, in which the certificates are handled as records in a database, which is called registry. The life cycle of a certificate consists of three simple steps:

- **Issuing**: Based on some form of evidence, e.g. meter readings and registered details of a production device, certificates are issued in the database and are placed in the registry account of the owner of the device, or a registrant which is acting on behalf of the owner.

- **Transfer**: Certificates can be transferred to other accounts within the registry where they have been issued, or to other registries, e.g. in other countries. Transfer is an optional step, it may be executed once or several times, but the certificate may also remain in the account in which it was issued.

- **Redemption**: The value of a certificate is realised by redeeming it. This means that the current owner intends to use the attributes which are represented in the certificate, e.g. for compliance with the disclosure scheme. Upon redemption, the certificate is removed from the owner’s regular account and is transferred to a redemption account, where it remains for documentation purposes.

It should be a general principle that the attributes recorded on a certificate may not be changed after the certificate has been issued.
The most comprehensive certificate system for electricity in Europe is the European Energy Certificate System (EECS). On the national level, several European countries have introduced certificate systems as support schemes in combination with demand obligations. Examples for such schemes are the “Elcert” system for renewable electricity in Sweden and the Renewable Energy Obligation in the UK.

Whereas under disclosure, certificate systems are currently used mainly for transferring attributes of RES-E and CHP-E, there is no reason why there should not also be certificates for any other type of electricity generation (based on fossil or nuclear energy sources), if there is a requirement or demand for explicit tracking of their attributes.

The potential downside of the de-linked tracking option is that it requires the setting up and the operation of a certificate system infrastructure. Some stakeholders have argued that such a system would be too expensive to justify its advantages in comparison to a contract-based system. A further potential drawback is that a full de-linking of the attributes from the electricity market would make it very easy to trade attributes back and forth across Europe. For final consumers, this could mean that the disclosure statements of retailers could be completely different than they would assume it to be based on e.g. their own generation or known relationships in the physical market. Although being fully correct in mathematical terms, such an allocation of attributes might undermine the credibility of the disclosure system among key stakeholders.$^2$

### 2.4 Implicit Tracking

In contrast to the two options for explicit tracking, implicit tracking is using a single default set of attributes for purposes of tracking, which is allocated to a large group of

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$^2$ For a more detailed discussion, see Timpe et al. 2003 and Boardman et al. 2003.
consumers. “Large” in this case means that not only the customers of a single retailer, but e.g. a significant share of customers in one country is receiving, at least in part, an identical set of attributes. In this case, no bilateral link is created between generation and consumption of electricity. Instead of this, averages of attributes from a (potentially large) group of power plants are being used as attributes for a certain volume of electricity consumption. Such averages might be derived from statistical data.

**Figure 5: Principle of implicit tracking**

Implicit tracking is currently only used in relation to the disclosure scheme. The use of implicit tracking makes sense here, as it has proven practically impossible to cover 100% of any electricity market with explicit tracking. One of the reasons for this is that every tracking regime has to deal with physical energy imports from regions where there is no comprehensive tracking system in place. For such imports, some form of implicit tracking is usually applied. As another example, if tracking is generally linked to energy contracts, then there will always be parts of the market where a bilateral contractual relationship can not be determined.

In many disclosure schemes, explicit tracking is optional and a default set of attributes for disclosure is provided as an alternative. This means that electricity retailers can choose to use explicit tracking if they wish. For all energy sales to final consumers which are not covered by attributes from explicit tracking, they have to use the default value.

The coexistence of explicit and implicit tracking has a major implication. In order to avoid multiple counting of the attributes which are tracked explicitly, the default value for disclosure must be corrected by all attributes which have been tracked explicitly. For details of the calculation of a residual mix, see chapter 4.6.
The use of implicit tracking also has a drawback in terms of informational value of the disclosure information. All retailers which are only relying on the default set of attributes will show identical company attribute mixes to their customers in their disclosure statements (fuel mix and emissions). This prevents consumers to choose between suppliers on the basis of the attributes of their electricity. Due to this effect, any disclosure scheme should try to minimise the use of implicit tracking to the extent possible.
Options for the Design of Tracking Systems

3 Scenario Analysis of 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 a European tracking standard.

It should be noted here that the scenario analysis refers to the actual implementation of tracking in a generic domain. The tracking options discussed below therefore depict concrete implementations of systems under the envisaged European standard. This analysis is meant to provide insights about the tracking options available and the variations which could be allowed under a standard.

3.1 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 this 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 (CHP-E)”

This descriptor can take on one of the following states:

A. Explicit tracking is mandatory for RES-E and CHP-E
B. Explicit tracking is mandatory for part of RES-E and CHP-E (e.g. for the use of RES-E or CHP-E under disclosure or if they receive support)
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.

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3 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.
Any specific tracking system design can be described as a combination of appropriate states of the descriptors, see the following illustration.

**Figure 6: Structure of the scenario matrix**

<table>
<thead>
<tr>
<th>Descriptor 1</th>
<th>State A</th>
<th>State B</th>
<th>State C</th>
<th>State D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptor 2</td>
<td>State A</td>
<td>State B</td>
<td>State C</td>
<td>State D</td>
</tr>
<tr>
<td>Descriptor 3</td>
<td>State A</td>
<td>State B</td>
<td>State C</td>
<td>State D</td>
</tr>
<tr>
<td>Descriptor 4</td>
<td>State A</td>
<td>State B</td>
<td>State C</td>
<td>State D</td>
</tr>
</tbody>
</table>

The full matrix for the development of scenarios represents the building blocks for the design of a tracking system. Obviously, not all combinations of options are sensible. The matrix allows for a structured development of tracking systems, or for the analysis of existing systems. A matrix template and the illustration of the individual options for the system design which are discussed below are included in Annex 2.

Based on the system development using the matrix, this report also uses textual descriptions of different options for tracking systems, which show the relevant range of options under discussion. These descriptions are contained in chapter 3.3. The analysis of tracking options is based on a set of evaluation criteria, which is outlined in the chapter below.

### 3.2 Evaluation Criteria for Tracking Options

The project team has selected six major criteria for the evaluation of tracking system designs. These can be used for a structured assessment of tracking options. The set of criteria takes into account discussions from previous studies, such as the 4C Electricity project (Boardman et al. 2003) and the Consumer Information on Electricity project (Palmer et al. 2003). They have been discussed with stakeholders during consultations, and some amendments have been made based on the comments received.

The following criteria have been selected:

**Informational value**

This criterion describes mainly qualitative aspects of the information that is gained, processed and provided by the tracking scheme. This might be regarded as the degree of “added value” through the tracking scheme compared to a business-as-usual scenario. It includes different aspects: What do consumers, other market participants, regulators and stakeholders gain from the information provided by the tracking scheme? Can consumers better distinguish between suppliers and their products? Can governments and regulators verify support mechanisms and accounting for RES-E targets in an efficient manner?
Accuracy

The criterion of 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 of attributes and the corresponding loss of other attribute information. This relates to the degree of precision achieved and the margin of error expected (not including errors and fraud by the actors involved, which are addressed by the criterion “robustness”).

As disclosure is a scheme using tracking results, which covers the whole electricity sector, accuracy can in theory be measured relatively simple: If all the disclosure statements in all domains involved would be added up, then this should match the attributes of power generation over the compliance period.\(^4\)

Robustness

Credibility of a tracking system is also highly depending on its resistance against “distortions” of information due to errors and fraud. One aspect in this regard is traceability, which means the ability of the system of recording and verifying the origin, any activities (e.g. issuing, transfer and redemption) and ownership of electricity attributes. Another aspect is the quality of verification procedures by third parties that are foreseen.

Feasibility

The implementation of the tracking system has to be feasible under realistic conditions of markets and other framework. Thus, the tracking system has to fit into the existing economic, socioeconomic, regulatory and legislative context. This implies that the tracking scheme should not be too complex and that it should not conflict with market conditions and functioning. In particular it should not endanger the liquidity of electricity markets. A further aspect is the possibility of fair participation of all market players and stakeholder groups.

Costs

The costs of the tracking system are another quite important criterion. When assessing the costs of tracking, this does not only mean the costs of data collection and the operation of a registry. A true cost analysis should address all cost items, including the transaction costs for market participants for using the system. When evaluating the costs for tracking, they should be compared to the costs of other solutions for implementing the schemes which require tracking (e.g. company-internal bookkeeping), and the benefits of the tracking system compared to these. Finally, as most of

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\(^4\) To be more precise, the attributes of generation would have to be adjusted by exports and imports, and by system losses.
the costs will most likely be passed on to final consumers, the costs can be related to the total electricity consumption in a domain or in Europe as a whole.

**Flexibility**

This criterion describes the ability of a tracking concept to adapt to different framework conditions both in terms of national or regional frameworks and their changes over time. The criterion of flexibility thus includes the ability to handle limited variations between tracking systems in different domains, e.g. in relation to a European tracking standard. Furthermore, the criterion addresses the extent to which the system will be able to adapt itself over time to lessons learned and to changing requirements.

Many of the criteria encompass several sub-aspects. For example: While ‘accuracy’ is a relatively straightforward criterion, the criterion ‘feasibility’ includes e.g. the aspect of (expected) acceptance by stakeholders together with other aspects.

For each tracking option outlined in chapter 3.3, a short textual description of the evaluation based on the criteria is given. In order to visualise the evaluation of the different tracking options, the text also includes a graph showing a rough numeric assessment. 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. It should be seen as a rough graphical indication of the strengths and weaknesses of the different approaches, but not as an accurate evaluation tool. The contribution of different sub-aspects to this ranking for each criterion is indicated in Table 1 on page 39.

Not surprisingly there are some trade-offs between different criteria. Therefore it will not be possible to meet all criteria to full extent. An adequate system design must rather be based on some form of balance, which might also reflect certain priorities between the different criteria.

### 3.3 Generic Options of Tracking Systems

This chapter presents four options for the design of tracking systems, which the project team has selected from a larger list of plausible scenarios. They are partly inspired by existing implementations of tracking systems in European countries, but in every case, an abstraction has been made in order not to focus on country-specific issues.  

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5 A significant distortion in terms of accuracy and informational value can occur in practice if an individual tracking option 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 general tracking 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
3.3.1 Contract-Based System (Option 0)

Description of the tracking scheme

Option 0 describes a full contract-based system, which means that attributes cannot be de-linked from electricity contracts. The system is designed for disclosure purposes only. 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 and therefore have no clear function.

Explicit tracking is generally mandatory for all kinds of generation and contracts, with the exemption of purchases from power exchanges and undisclosed imports. For these exemptions from explicit tracking, specific regulations apply: For power exchange transactions, net sellers into the exchange must notify their attributes to the operator of the exchange. This allows calculating monthly averages of an internal power exchange attribute mix, which are applied to all net purchases from the exchange during this period. For undisclosed imports and other electricity of unknown origin, default values of attributes must be used which are based on overall generation statistics (e.g. 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. Information of the use of major support systems for generation has to be indicated in related contracts.

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 tracking functionality for 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.

\[\text{different tracking options, all options are supposed to be applied on a mandatory basis for the schemes indicated, at least for disclosure.}\]

\[\text{This option has been inserted after the second round of consultations. From a logical point of view, it must be placed first in the sequence of options. In order to not confuse the participants of the consultation process, the codes of the other options have been maintained, and this new option has been called ‘Option 0’.}\]
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 actually 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 retailers. 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 direct conflict between the criteria of feasibility (including compatibility with market requirements) on the one side and informational value and accuracy on the other. 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 expensive and 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.
3.3.2 Ex Post Contract Tracking (Option A)

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 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. 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 CHP, nor does it report whether a support mechanism has been used.

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Note that even suppliers with a high share of own production might use the power exchange for at least part of their generation, thus preventing a straightforward calculation of electricity balances. For a description of the ex post contract tracking mechanism, see chapter 4.5 and Annex 1.
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**

A coexistence of several options for tracking attributes (the standard ex post procedure plus optional explicit (ex ante) 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 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 ex ante contract-based tracking, certificates and Guarantees of Origin are used to a significant extent at least 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. Then again, the requirement to redeem certificates in order to use their information content for disclosure provides for protection against multiple use of certificates. 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.
3.3.3 Voluntary Certificate System Plus Residual Mix (Option B)

Description of the tracking scheme

Similar to option A, explicit tracking of electricity is generally performed on a voluntary basis. However, a certificate system is established and it is the only accepted source of information for explicit tracking. Guarantees of Origin for RES-E and CHP-E are fully integrated into the certificate system, but this system is also available for all other types of electricity generation. The tracking system includes a scheme for international accounting of attribute transfers across borders for national RES-E targets.

Due to the specific interests of consumers in RES-E and CHP-E, 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 must be used as default value for implicit tracking if no explicit tracking information is available. In case of international transfers, regulations are set up in order to enhance reliable accounting 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 implicit tracking. Such a cap could be implemented because all market participants are able to use certificates for explicit tracking.

The tracking information includes a standardised list of energy sources for electricity generation and environmental indicators for disclosure. Furthermore, certificates record the production period and the issuing date. If support for RES-E or CHP-E 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 cer-
tificates on a voluntary basis. The support systems for RES-E and CHP-E 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. The regulator performs verification audits of tracking results on a random basis.

**Evaluation of Option B**

This tracking option could be regarded as 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 which must be used 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 (restricted only by a potential cap on implicit tracking). Explicit tracking is only required for shares of green electricity and CHP in portfolios and for all electricity products. These parts of the market have a higher market value which could justify the effort of explicit tracking.

These regulations could 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 CHP-E are not linked to the tracking scheme. The actual impact of this depends on the detailed regulations for coordination of both systems.
3.3.4 Ambitious Certificate System (Option C)

Description of the tracking scheme

This option is a comprehensive certificate system including automatic issuing of certificates for all kinds of electricity production and mandatory redemption for disclosure. Default disclosure data based on a residual mix is restricted to very limited cases. Guarantees of Origin for RES-E and HE-CHP are fully integrated in the tracking system. Different to the other options, in this case the certificates from all European countries are managed in a central database at the EU level. Exports and imports of attributes are only possible based on transfers of certificates.

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 CO₂ 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, if applicable. Due to the integration of GO and a comprehensive registry setting, the system can be used for target accounting for RES-E (and for CHP-E, if required). Other standard information on the certificates 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-E 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 separate transferable disclosure, support and target certificates (multi-certificate system).

In addition to these features, strict requirements apply for the 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. Due to 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 high verification requirements 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 take 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.
Figure 10: Rough numeric assessment of tracking option C

3.3.5 Summary of the Rough Numeric Assessment of Tracking Options

The following table provides an overview over the numeric assessment, including the qualitative contributions of different sub-aspects of the criteria to the result. For the sub-aspects, three levels have been applied: Negative (−), neutral (O) and positive (+).

Note again that this numeric evaluation can not reflect the complexity of the evaluation from above. It should be seen only as a rough graphical indication of the strengths and weaknesses of the different approaches.
Table 1: Rough numeric assessment of tracking options

<table>
<thead>
<tr>
<th>Sub-aspect</th>
<th>Option O</th>
<th>Option A</th>
<th>Option B</th>
<th>Option C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Ex post</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Informational value</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>product differentiation/distinction of products</td>
<td>O</td>
<td>O</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>generally usable for support and target accounting</td>
<td>–</td>
<td>–</td>
<td>O</td>
<td>+</td>
</tr>
<tr>
<td>Accuracy</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>avoiding multiple counting</td>
<td>O</td>
<td>–</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>correct data input</td>
<td>–</td>
<td>O</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Robustness</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>resistance against distortions</td>
<td>–</td>
<td>–</td>
<td>O</td>
<td>+</td>
</tr>
<tr>
<td>Feasibility</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>accordance to regulatory and legislative framework</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>accordance to market principles</td>
<td>–</td>
<td>+</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>effects on liquidity of markets</td>
<td>–</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>fair participation of all market players</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>–</td>
</tr>
<tr>
<td>Cost</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Cost for implementation</td>
<td>+</td>
<td>+</td>
<td>O</td>
<td>–</td>
</tr>
<tr>
<td>Cost for operation</td>
<td>–</td>
<td>O</td>
<td>O</td>
<td>–</td>
</tr>
<tr>
<td>Flexibility</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ability to adapt to different national or regional frameworks</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>ability to adapt to changes over time</td>
<td>+</td>
<td>+</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

3.4 Conclusions from the Scenario Analysis

From the evaluations in the previous chapter, the following conclusions and recommendations for key features of future tracking systems have been derived:

- It is not necessary to make a general decision regarding contract-based tracking versus de-linked tracking (based on certificates). Both types of tracking can be combined: If all explicit tracking is based on certificates, then these can be re-bundled with contracts, if desired.

- 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-E should be integrated into the explicit tracking mechanism.
Implicit tracking should feature a residual mix, which corrects 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 further development of the E-TRACK standard.
4 Elements of the E-TRACK Standard

In the following, the most relevant elements of the standard are outlined. Additional technical details are provided in the E-TRACK work package 4 report (Pooley et al. 2007).

4.1 Tracking Standard vs. Tracking Systems

Whereas the previous chapter 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 single tracking system. In response to the existing variations in policies and tracking systems already in place, the project is rather 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 with the standard, could be developed further to meet the standard in the future.

It must be noted that although we use the term “standard”, the E-TRACK standard is not intended to be converted into a formal standard following the rules of international standardisation organisations like CEN and Cenelec. This question has been discussed with stakeholders in the consultations, and there was a clear support for a more informal standard which is governed by an independent grouping with a joint code of practice. For details on the governance of the standard, see the E-TRACK work package 4 report (Pooley et al. 2007).

4.2 Registries for Handling of Certificates

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 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. There should be only one registry per domain, because in a situation with several registries it will be difficult to coordinate the registration of production devices and the issuing, which could lead to multiple counting.

Inter-registry communication should be facilitated through a central hub, which enables the exchange of certificates and management of joint information for all tracking systems participating in the E-TRACK standard (see the E-TRACK work package 4 report for details).

The Guarantees of Origin for RES-E and CHP-E, as introduced by the relevant 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 might be used as evidence for cross-border transfers of attributes under the indicative targets for RES-E. In case that a plant can receive Guarantees of Origin for both RES-E and for CHP-E (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 information (see chapter 4.6).

### 4.3 Single and Multi-Certificate Systems

So far we have assumed that a certificate is a single set of attribute information, issued based on evidence of power generation. In a single certificate system, it is a principle that only one certificate may be issued for any instance of electricity generation in order to avoid multiple counting.

However, we have to reflect the fact that there are different schemes which might require the use of certificates as accounting units for explicit tracking. As mentioned in chapter 2.1, there are three generic schemes: disclosure, support and target accounting.³

These schemes might require the use of the attributes at different points in time (e.g. based on different compliance periods) or by different actors. For example, the disclosure scheme requires retailers to redeem certificates (or to use the residual mix), whereas the support scheme might require generators to redeem certificates in return for a premium payment. The timing of these two requirements is not necessarily coordinated.

³ Note that the supply of green power can generally be seen as a specific form of disclosure, where the retailer binds itself ex ante to claims on the origin of the electricity supplied.
In principle, there are three types of certificate systems which show different flexibility with regard to the generic schemes disclosure (D), support (S) and target (T):

**Single certificate system with single use**

This is the “classic” understanding of how a certificate works. For each instance of electricity generation, only one certificate may be issued. The certificate combines all the associations to schemes which are relevant. The certificate can be transferred and when it is redeemed, all the associations to schemes are redeemed at a time. This is shown in the figure below, where a single certificate has associations to all three generic schemes.

*Figure 11: Single certificate system with single use*

The drawback of this system is that there is no flexibility in terms of who is redeeming the certificate for a certain scheme and when this is done. This requires an advanced and harmonised formulation of scheme regulations.

**Single certificate system with sequential use**

This option is also based on only one certificate which may be issued for each instance of electricity generation. However, the associations of this certificate to different schemes may be redeemed one after the other, at different times and by different actors. For example, a system operator who has paid a feed-in tariff to the generator, can redeem the support association in return for a financial compensation from public funds, and then sell the certificate onwards to a retailer, who is redeeming the disclosure and target associations. This example is shown in the figure below.
Figure 12: Single certificate system with sequential use

Scheme associations: D = disclosure, S = support, T = target

This option allows for more flexibility than the single certificate single use system, and therefore might be compatible with different types of scheme regulations. However, the existence of different types of certificates, depending on their redemption status, increases the complexity of the tracking system, while not giving the same range of flexibility as the multi-certificate system.

Multi-certificate system

This option is allowing several certificates of different types to be issued for a single instance of electricity generation. The certificates can be transferred and used independently from each other. This is a fundamental change compared to the two single certificate options above.

In order to prevent multiple counting, it is important that the types of certificates are defined clearly and that their associations to the different schemes can not be changed, misused or simply misunderstood by market participants.

The multi-certificate system offers the highest flexibility. If the safeguards mentioned above are accomplished, then this system can be as reliable as a single certificate system.
In a practical application of the multi-certificate system, it could be possible to implement certain restrictions on the separation of scheme associations. For example, as stated above, the Commission has declared that transfers of the target association across borders between Member States must be based on the transfer of a GO. This could be implemented by a regulation that the certificate which is associated to the target scheme (“T” in the figure above) may only be transferred in combination with the certificate which is associated to the disclosure scheme (“D” in the figure above).9

This form of the multi-certificate approach has practical relevance in those countries which have implemented support systems based on obligations, and which are using support certificates which are not linked to GO. In this case, there may be two separate certificates from a single instance of generation: The GO, which can be used for disclosure and potentially also for the transfer of the target association, and the support certificate, which is only relevant for facilitating financial support to the generators. Such systems exist e.g. in the UK and in the region Wallonia in Belgium. In Sweden, a clarification of the role of the “Elcert” certificates is under way, which might also implement this type of system.

However, there have also been arguments that in the case of RES-E, the target association should better be linked to a support certificate, and not to the Guarantee of Origin. This would enable European countries to set up joint support systems based on such certificates (like the system which was envisaged between Sweden and Norway, but

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9 Note that as the GO has been interpreted as being linked to electricity disclosure, therefore the equivalent of a GO in Figure 13 is the certificate which is associated to the disclosure scheme.
which was never realised). Here, a country paying for the support of a generation epi-

sode would wish to have this volume of RES-E generation credited towards its target.
However, in this case the question which consumer has used the related electricity at-
tributes in terms of disclosure, and has probably paid a higher price for RES-E, would
not be linked to the accounting for targets any more. A potential discrepancy between
RES-E shares in disclosure statements in a country and its performance against the
RES-E target could be confusing for stakeholders.

As a result from this discussion, two conclusions can be drawn:

- In principle both options are possible: The target association can either be linked to
  the disclosure certificate (i.e. the GO) or to the support certificate (but never to both
  certificates at a time, if these are separated). This is a policy decision which should
  be taken by governments.

- There seems to be no use for a fully separated transferable target certificate, as there
  is no market for it.

Note that this discussion assumed that the government of the country of production of
RES-E has agreed to issue a certificate with the target association. Under the current
regulations this is under the discretion of the government.\(^\text{10}\)

Given the requirements from Member States for a flexible design of support systems,
the E-TRACK standard not only accommodates for the concept of a single certificate
system with single use, but also allows for a separation of support certificates. This re-
quires certain safeguards against multiple counting of attributes (see above). Based on
the existing framework set by the Commission, the target association should remain
linked to the Guarantee of Origin, but in the future it might also be possible to link it to
a separate support certificate. The sequential system is less flexible than the multi-
certificate approach and therefore is not pursued further.

For simplification, the singular term “certificate” will be used in most parts of this re-
port, although this might refer to all (multi-) certificates which have been issued for a
single instance of energy. Only if the potential existence of support certificates is rele-
vant, this will be mentioned explicitly.

### 4.4 External Reliable Tracking Systems

So far we have distinguished between explicit tracking systems, which can be imple-
mented based on certificates as standardised accounting units, and implicit tracking,
which should use a residual mix. In principle, these two elements would be sufficient to
set up a tracking system for all relevant schemes. However, in practice a variety of
tracking systems already exists for certain parts of the market, some of which will not
simply disappear at the time when a new tracking standard is introduced in Europe.

\(^{10}\) From what is known so far, this option has hardly been used by governments until now.
It must be noted that at least for purposes of disclosure, the relationship of a European tracking standard to all other allocation mechanisms must be clarified. Because disclosure requires a tracking system which covers 100% of the electricity market, there may not be several competing tracking systems in place. Any uncoordinated coexistence of tracking systems for disclosure purposes would result in multiple counting.

This means that where possible, all existing tracking systems should be integrated into the implementation of the E-TRACK standard. For example, the existing GO systems in the domains joining the E-TRACK standard should become part of the certificate system in the respective domain. Also, green power quality labels should use disclosure certificates as the exclusive tool for verification of the origin of electricity instead of own accounting systems.

In practice, however, this will not work in all cases, as there are other tracking systems which might continue to coexist with the E-TRACK standard at least for a certain period of time:

- Some national support systems for RES-E or CHP-E facilitate an allocation of the supported energy production to final consumers in terms of disclosure, which is not based on GO or disclosure certificates. For example, the German feed-in mechanism has a separate procedure of how the supported energy is allocated to retailers on a pro-rata basis.

- Other national support systems might not be linked to disclosure, but it might not be possible to integrate them into the concept of a harmonised tracking system as defined by the E-TRACK standard due to political or practical reasons. The proper handling of support in a European tracking system might require reflecting this co-existence.

- In some countries, allocation systems have been established for purposes of disclosure which are not fully compatible with the E-TRACK standard. For example, Germany has developed an ex-post contract-based allocation system (see chapter 4.5). In principle such systems could be implemented based on the standardised accounting units under the E-TRACK standard, but again this might not be possible due to political or pragmatic reasons.

Therefore, it is important that the E-TRACK standard defines the relationship to these tracking systems. In terms of disclosure, the problem of coexistence of tracking systems can be solved by taking the attributes covered by these systems into account when calculating the residual mix (see chapter 4.6). This could avoid the multiple counting problem, provided that sufficient information is available for the residual mix calculation.

In order to maintain a high level of accuracy and reliability, any Domain wishing to join the E-TRACK standard but intending to maintain separate tracking systems would have to prove that these separate systems do not compromise the performance of the tracking systems under the standard. For such separate tracking systems, the term “External Re-
liable Tracking System (ERTS)” has been defined. Typically, ERTS are administrated by governmental bodies, e.g. for implementing a support system.

Criteria for the acceptance of the coexistence of ERTS with the E-TRACK standard could include:

- The ERTS should be accurate and reliable in its allocation of attributes.
  
  This means that the attributes of generation covered by the ERTS are clearly allocated to final consumption of electricity. No attributes may be lost or counted more than once.

- If an ERTS is facilitating disclosure, including product differentiation and green power quality labelling, then it should be able to satisfy the related requirements on information content.
  
  The ERTS should provide all the necessary information to final suppliers to meet their disclosure obligation.

- The ERTS should be able to exclude multiple counting in relation to disclosure certificates and Guarantees of Origin for RES-E and CHP-E.
  
  This means that for any production device and for any production period, it should be clear whether the generation attributes are covered by a certain ERTS or not, and if yes, in association to which schemes. This allows the tracking system under the E-TRACK standard to exclude multiple issuing. ERTS should verify whether disclosure certificates have been issued under the E-TRACK standard and may not double issue.

- The ERTS should be able to exclude multiple counting in relation to the residual mix under the E-TRACK standard.
  
  This means that the body which is responsible for determining the residual mix should have a complete overview on all generation which is covered by any ERTS for purposes of disclosure, and the related generation attributes. This also implies that ERTS should not expand across several disclosure domains without appropriate coordination between the corresponding system administrators.

- If an ERTS is facilitating the issuing of support certificates, then it should avoid the wrong use of these certificates for disclosure as well as multiple counting of the underlying electricity generation for other support schemes.
  
  The ERTS should enable all market participants and regulatory bodies to clearly distinguish these support certificates from disclosure certificates. This includes a clear communication of the support system and its relation to disclosure. Multiple counting should also be prevented in relation to other (exclusive) support systems.

Under the condition that these requirements are met, the coexistence of the ERTS with the tracking system under the E-TRACK standard can be managed. Most importantly,
all electricity attributes covered by these systems for purposes of disclosure must be taken into account when calculating the residual mix.

Tracking systems which do not meet these requirements should adapt themselves to the E-TRACK standard in order to avoid multiple counting of attributes. This applies specifically to most quality labels for green power which are operated by private or public entities. These labels can increase their reliability by using the tracking mechanism established under the E-TRACK standard. However, this in turn might require the standard to convey additional information on the disclosure certificates, which is required for the operation of such labels. These could be added to the certificate system as optional data.

As stated above, there should be no other tracking system in place in any domain than the implementation of the E-TRACK standard and ERTS which fulfil the criteria set by the standard. This is illustrated in Figure 14.

Figure 14: Relationship of External Reliable Tracking Systems to the E-TRACK standard

<table>
<thead>
<tr>
<th>Explicit tracking based on registries under the E-TRACK standard</th>
<th>External Reliable Tracking Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual mix calculation under the E-TRACK standard</td>
<td></td>
</tr>
</tbody>
</table>

It must be emphasised again that it would be desirable to integrate all tracking systems into the E-TRACK standard in the longer term and thus to remove the parallel existence of ERTS. This would help to reduce the complexity of tracking procedures, and to avoid errors.

4.5 Ex Post Contract-Based Tracking

Contract-based tracking systems are using information about bilateral transactions on the physical electricity market for the allocation of attributes. In this case, explicit tracking means that both parties of a physical contract agree on the attributes to be submitted from the seller to the buyer, e.g. certificates on the attributes of renewable energy. This agreement is made “ex ante”, i.e. at the time when the physical contract is concluded.\footnote{As stated in chapter 2.3, such ex ante agreements connected to physical contracts should not become mandatory, because this would deteriorate the liquidity in electricity markets.}
The actual submission of the attributes in the registry can only take place after the production of the respective instances of electricity. The ex-post contract tracking mechanism uses existing information about bilateral transactions in the physical electricity market in order to allocate attributes which would otherwise be represented in the residual mix. The allocation of these attributes is determined “ex post”, i.e. after the actual delivery of energy, based on the net transaction balances between all trading parties in the physical electricity market. Under this mechanism, a generator is determining his overall attribute mix after the end of a compliance period and this mix will then be allocated to all traders who have at large purchased energy from this generator during the period. The attributes can thus be passed on along the trading chain in the electricity market to the retailer. This all happens well after the contracts have been concluded and the related energy was generated and consumed. (See Annex 1 for a more detailed discussion of this approach.)

This variant of contract-based tracking avoids the market liquidity problems, which are associated with the ex ante contract-based approach. However, because the attributes of the seller are not known to the parties of an electricity contract at the time when the contract is concluded, the ex post mechanism is not equivalent to explicit tracking, because it is not possible for market participants to steer their attribute portfolio under this approach. The ex post mechanism is rather using existing information from physical electricity markets to determine a pattern for the allocation of generation attributes to electricity retailers, which would otherwise be part of the residual mix. It therefore follows a “best available information” approach in order to reduce the share of the residual mix. In combination with explicit tracking, this can support the differentiation between suppliers based on their disclosure portfolios while at the same time not hindering market liquidity. Nevertheless, due to the lack of targeted allocation of attributes, this tracking option is only suitable for that part of the market, where active management of attributes is not regarded as relevant.

Given these pros and cons of the ex post contract tracking mechanism, this allocation method should be treated as an External Reliable Tracking System (ERTS) under the E-TRACK standard. This means that if the conditions set out in chapter 4.4 are met, then this mechanism might exist in parallel to the E-TRACK standard. For example, the requirement of reliability, which is placed on ERTS, means that the data input and the results from the mechanism must be subject to third party verification. However, in principle it would be preferable to facilitate the allocation of attributes under this system not in bilateral communications or through a separate communication platform, but rather using the certificate system with its procedures of production device registration, handling of certificates in a registry, and a structured environment for using attributes. This would mean an integration of the ex post allocation in to the E-TRACK standard.

Attributes which have been allocated to retailers based on the ex post mechanism constitute part of the company attribute mix for disclosure. However, because the mechanism does not involve active acquisition of specific attributes by the retailer, it should
Options for the Design
of Tracking Systems

not be allowed to split up the attributes allocated based on this mechanism and to use them for product differentiation. Specific products should be based on explicit tracking only.

Therefore, if a domain has chosen to use contract-based tracking as the main tracking option, then it could consider supplementing the basic elements of the E-TRACK standard, certificates and the residual mix, by the ex post contract tracking mechanism. The ex post system could be applied at least to all energy trading through a power exchange, but it could also be extended to all physical transactions in the power market.

In total, the tracking system would then consist of up to four elements:

- Explicit tracking based on certificates held in a registry
- Support schemes with allocation of attributes (if applicable)
- Allocation through an ex-post contract tracking mechanism
- residual mix

Both the allocation through support schemes and the ex post contract tracking mechanism would be regarded as External Reliable Tracking Systems and would have to meet the respective criteria. The calculation of the residual mix for this domain would have to take into account the attributes allocated based on explicit tracking and on both types of ERTS.

4.6 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 for purposes of electricity disclosure (implicit tracking). The residual mix represents all attributes in a certain domain (or a group of domains which are cooperating in a residual mix region), which have not been allocated to final consumption of electricity within a certain compliance period based on explicit tracking or ERTS. 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 into 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 or ERTS is available. In these cases, the use of the residual mix should be binding.

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12 This requirement should also apply for the individual steps of electricity trading, i.e. a trader should not be allowed to split up his attribute portfolio under this mechanism to different wholesale trading partners.
The residual mix not only consists of a 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 multiple counting, the residual mix in any region should only be used for disclosure of a volume of electricity which is equivalent to the volume of the residual mix.

The compliance period for electricity disclosure under the E-TRACK standard is a calendar year. In order to maintain a coherent database, and to avoid multiple counting and loss of information, the lifetime of the association of certificates to the disclosure scheme must be limited. The schedule could look like this:

- Within year A, electricity is generated and consumed.
- No later than four months after the end of year A, all meter data relating to electricity generation in year A must have been processed, certificates must have been issued (if so ordered by the generator) and all transactions with certificates 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 a compensation for the current holder. The electricity attributes represented by these certificates will become part of the residual mix.
- After six months after the end of year A, the residual mix is calculated and published.

Note that the proposed timing of these steps is indicative; it would have to be defined by the scheme authorities for disclosure. However, in order to avoid unintended interaction between the certificate markets in different domains, all disclosure domains should strive to agree on a joint deadline for explicit tracking.

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 for communication between the certificate registries.

The calculation of the residual mix for a certain geographical region (a residual mix region, which can consist of one or several tracking domains) is following three steps:

1. The preliminary residual mix is calculated for the region as follows:
   - Attributes of all electricity generation in the residual mix region (e.g. based on data taken from appropriate statistics)

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13 The first period of six months has been proposed in order to allow the tracking system to use the plant-specific monitoring data from the ETS system. This data is verified and finalised by the relevant authorities each year by 1 May for the emissions of the preceding year, and it could be used for the CO₂ emissions information on certificates.

14 See the E-TRACK work package 4 report for details on communication infrastructures (Pooley et al. 2007).
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 regions and other European countries. An accurate solution would require the separate analysis of all bilateral net trading relationships, which seems to be too complex; and in the case of physical exports and imports, the required data would not be available. As a simplified approach to this correction, a superior European attribute mix is calculated for all countries participating in the E-TRACK standard.

- For this superior European attribute mix, each residual mix region firstly determines the volume of total electricity delivered to final consumers and the volumes of attributes available from redeemed certificates for disclosure, External Reliable Tracking Systems and the preliminary residual mix. The difference between the two volumes is calculated as a surplus or deficit in attributes per residual mix region.

- All residual mix regions notify the size of their surplus or deficit and the attributes of their preliminary 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 Region 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 superior European attribute mix.

3. All those residual mix Regions which have a deficit of attributes compared to electricity delivered use this superior European attribute mix to fill up their preliminary internal residual mix to the volume required for full disclosure in their residual mix Region. All those residual mix Regions, which have a surplus of attributes compared to electricity delivered, use their preliminary internal residual mix for disclosure purposes, which has been reduced in volume to the size required to cover the electricity consumption in the domain.

This procedure is illustrated in the figure below.
Figure 15: Relation between disclosure domains and the superior European attribute mix

This procedure ensures that in each residual mix region the volumes of attributes available match the actual consumption of electricity. This avoids the multiple counting of attributes which would otherwise be caused by the effects of exports and imports of electricity and attributes.
5  Outlook

Based on the analysis of tracking options and the related conclusions, a recommendation for the design of specific elements of tracking systems under the E-TRACK standard was developed in this report. These elements constitute the general ingredients for the E-TRACK standard. A more detailed analysis of the technical requirements for such a standard can be found in the E-TRACK work package 4 report (Pooley et al. 2007). The work package 5 report (Ritter et al. 2007) includes an analysis of the costs of tracking systems and their assessment in relation to the benefits provided. Based on these inputs, the final project report (Timpe et al. 2007) then develops the condensed description of the E-TRACK standard and a plan for its implementation.
6 References

AIB 2007: Personal message from Phil H. Moody, Secretary General of the Association of Issuing Bodies (14.08.2007).


http://www.re-go.info/downloads/summary.pdf


Annex 1  Discussion of the Ex Post Contract-Based Tracking Mechanism

The ex post contract-based tracking mechanism uses the net transaction balances between all participants in the physical electricity market of a certain domain for the allocation of attributes from generators to retailers of electricity. This procedure can be used for electricity disclosure and is performed after the end of the compliance period, e.g. the calendar year. The allocation of attributes is based on the net transaction balances in the energy market over this period. The netting of the gross bilateral trading volumes removes the pure financial contracts in the electricity market and significantly reduces the volumes to be transferred.

The ex post tracking mechanism can be executed in four steps:

1. Each market participant determines the net electricity trading balances with all its counterparts in the electricity market within the same domain over the compliance period.

2. All generators account for the attributes covered by explicit tracking and External Reliable Tracking Systems (other than the ex post tracking mechanism) and determine their remaining generator attribute mix (all attributes of their generation minus those covered by explicit tracking and other ERTS).

3. Each generator notifies its net buyers about its remaining generator attribute mix. Each intermediary in the electricity market uses this information in order to determine its company attribute mix as an average of the company mixes of all sellers, from which the intermediary has had a net purchase of electricity. This average is weighed by each intermediary with the respective volumes of the bilateral net purchases. The result is then notified to those electricity retailers who have had a net purchase from the intermediary. This allows all retailers (and those final consumers who participate in trading of electricity) to determine their preliminary company mix.

4. Finally, the preliminary company mix of retailers is supplemented by the attributes which they have acquired through explicit tracking and other External Reliable Tracking Systems.

It is important that in this procedure, only company mixes are handled. It should not be allowed to extract e.g. the renewable part from a company mix in order to allocate it separately from the other attributes. For such separation of attributes, explicit tracking must be used.

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This description is based on the recommendation of the German branch organisation, VDEW, for the implementation of electricity disclosure in Germany (VDEW 2005). However, some features of the mechanism have been modified in order to improve the accuracy of the results.
In practice, the procedure is more complex, as in liberalised electricity markets, there is no clear hierarchy from generators via intermediaries to suppliers and consumers, but rather many of the market actors, including generators, are both buyers and sellers at the same time. This makes it impossible to do the allocation of attributes as straightforward as described in step 3 above. As a solution, step 3 can be performed in several iterations, where in the beginning, generators who do not yet know the attributes of electricity which they have bought from other actors, mark this share of their attribute mix as “unknown”. Over several iterations of the step 3 procedure, the company mix of the suppliers will converge to the “true” solution of an ideal mathematical allocation, and the “unknown” part will be minimised.

It is also possible to integrate power exchanges into this procedure. For this, exchanges would be regarded as market intermediaries, which can determine their “exchange attribute mix” for a calendar year or a shorter period, based on the company mix information from all net sellers to the exchange.

Imports and exports of physical energy must be dealt with as well. If net exporters into the domain in question are ready to declare attributes for their net exports, these could be used. If such information is not available, this import could be treated as unknown (and an appropriate residual mix could be applied in the final stage of determining supplier mixes). Note that the residual mix calculations of the E-TRACK standard provide a better approach to the treatment of exports and imports.

The major benefit of using this somewhat complex procedure is that existing information from the physical markets is used to determine a pattern for the allocation of generation attributes to suppliers of final consumers. The ex-post mechanism is therefore following an approach of using the best available information. For example, if suppliers own generation (without prejudice of the requirements for unbundling), the application of this procedure will most likely result in a disclosure portfolio which contains the attributes from their own generation. This would be more useful information for consumers than the statistical information from the residual mix. The procedure allows to significantly reduce the share of the residual mix in the disclosure information, which supports the differentiation of supplier portfolios and therefore consumer choice.

However, it is important to recognise that the effects of the ex-post contract tracking mechanism are not comparable to those of explicit tracking. Because the ex-post mechanism is determining attribute mixes of market participants only after the end of the accounting period for disclosure, this information can not (and is not meant to) have a relevant impact on the purchasing decisions. The allocation of attributes therefore is not managed actively, as it would be the case with explicit tracking; it is rather a secondary effect of physical electricity trading. On the other side, it is possible that the known

16 Different from this, the VDEW recommendation uses the average generation attributes of the UCTE system as a proxy value. This external proxy leads to some error in the accounting of attributes. Based on a provision in German legislation, the VDEW recommendation also uses the attributes of the UCTE mix for all transactions at the power exchange.
attributes of a generator might influence its position in the electricity market, if these attributes become of interest for the buyers of electricity. Based on these considerations, it is clear that the ex-post contract tracking mechanism can not replace explicit tracking, but can supplement it in order to reduce the share of the residual mix.

Therefore, the ex-post contract tracking mechanism will be treated as an External Reliable Tracking System under the E-TRACK standard, similar as supports systems which allocate electricity attributes to retailers and consumers. This means that the respective criteria as set out in chapter 4.4 must be fulfilled.

In this context, it is important that adequate measures are taken to ensure and verify the accuracy of the calculations of the company mixes in each iteration by each trading participant. This can be supported by e.g. the mandatory use of a certified spreadsheet calculation tool for the calculations to be done by each trading partner, which can be provided by e.g. the disclosure Scheme Authority, and by independent verifications of the calculation results as well as input date to the tracking mechanism.

In any case, it would be sensible if all ERTS, including ex-post contract tracking mechanisms, would be integrated into the tracking options under the E-TRACK standard. This could imply that the allocation of attributes is still derived from the bilateral net trading balances in the electricity market, but that the execution of the attribute allocation would be based on the transfer of certificates in the registry.

Until this is achieved, it is also important that the ex post tracking mechanism can report the total volume of attributes which it has allocated and the details of these attributes, in order to allow for the corresponding correction of the residual mix.

It should also be noted that, besides the general opposition which contract-based allocations experience specifically from many energy traders, the sound management of an ex-post contract tracking mechanism can mean that at one point in the system, a complete picture of all net trading relationships in the electricity market is generated. It is obvious that this is very sensitive information. So if this aggregation of information can not be avoided, then it must at least be treated with extreme caution with regard to confidentiality.
Annex 2  Scenario Tables

Scenario matrix – Template
Scenario matrix – Option 0
Scenario matrix – Option A
Scenario matrix – Option B
Scenario matrix – Option C
<table>
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<tr>
<th>No.</th>
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<th>State A</th>
<th>State B</th>
<th>State C</th>
<th>State D</th>
<th>State E</th>
<th>Explanations</th>
</tr>
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<tbody>
<tr>
<td>A.1</td>
<td>Explicit tracking for non-RES-E / non-HE-CHP generation?</td>
<td></td>
<td>Mandatory for all transactions</td>
<td>Mandatory, except undisclosed imports and purchases from power exchanges</td>
<td>Mandatory for long term contracts</td>
<td>Voluntary</td>
<td>Not possible</td>
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<tr>
<td>A.2</td>
<td>Explicit tracking for RES-E and HE-CHP generation?</td>
<td></td>
<td>E.g. via GOs</td>
<td>Mandatory for RES-E and HE-CHP</td>
<td>Mandatory for part of RES-E and CHP</td>
<td>Voluntary</td>
<td>Not possible</td>
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<tr>
<td>A.3</td>
<td>Use of standardised accounting units for explicit tracking</td>
<td></td>
<td>E.g. certificates, tags</td>
<td>Mandatory</td>
<td>Optional</td>
<td>Never</td>
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<tr>
<td>A.3.1</td>
<td>Limited lifetime of accounting units</td>
<td></td>
<td>Acc.units can be used only for the calendar year of issuing</td>
<td>Acc.units can be used longer than the calendar year of issuing</td>
<td>Unlimited</td>
<td></td>
<td>Technically unlimited, but limited by regulations of tracking uses</td>
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<tr>
<td>A.4</td>
<td>Explicit tracking can be de-linked from electricity contracts?</td>
<td></td>
<td>Yes, standard</td>
<td>Optional</td>
<td>No</td>
<td>Not possible</td>
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<tr>
<td>A.4.1</td>
<td>(Standard) Explicit tracking mechanism linked to balances of electricity trading?</td>
<td></td>
<td>Yes post contract tracking, e.g. as in Germany</td>
<td>Yes</td>
<td>Optional</td>
<td>No</td>
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<tr>
<td>A.5</td>
<td>Physical connection required for participation in tracking?</td>
<td></td>
<td>Related to off-grid supply and exchanges of attributes from overseas</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>A.6</td>
<td>Use of registries for explicit tracking</td>
<td></td>
<td>Mandatory for all explicit tracking</td>
<td>Optional</td>
<td>No registry available</td>
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<tr>
<td>A.6.1</td>
<td>Type of registries</td>
<td></td>
<td>Unique European registry</td>
<td>Unique registry per country or domain</td>
<td>Several parallel registries</td>
<td>No registry</td>
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<td>A.7</td>
<td>Use of statistical averages (implicit tracking)</td>
<td></td>
<td>No default value available</td>
<td>Limited to certain volumes/transactions</td>
<td>Unlimited</td>
<td></td>
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<tr>
<td>A.7.1</td>
<td>Limitation of total share of statistical averages within portfolio?</td>
<td></td>
<td>Unlimited</td>
<td>Limited to a certain share</td>
<td>Unlimited</td>
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<td>A.7.2</td>
<td>Limitation of use of statistical averages for certain transactions?</td>
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<td>Unlimited</td>
<td>Limitation for certain transactions</td>
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<td>A.7.3</td>
<td>Type of statistical average used</td>
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<td>European (more than UCTE)</td>
<td>Transmission system, e.g. UCTE</td>
<td>Region (several countries)</td>
<td>National</td>
<td>Sub-national</td>
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<td>A.7.4</td>
<td>Correction by attributes tracked explicitly</td>
<td></td>
<td>Corrections result in a residual mix</td>
<td>Unused certificates are collected for the residual mix and redeemed</td>
<td>Other forms of correction by all attributes being tracked explicitly</td>
<td>Other forms of correction by part of the attributes being tracked explicitly</td>
<td>No correction</td>
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<tr>
<td>A.8</td>
<td>Handling of specific &quot;low-information&quot; processes</td>
<td></td>
<td>Rating according to descriptors A.8.1 to A.8.5</td>
<td>Ambitious approach</td>
<td>Moderate approach</td>
<td>Less ambitious approach</td>
<td></td>
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</tr>
<tr>
<td>A.8.1</td>
<td>Handling of imports without explicit tracking</td>
<td></td>
<td>Use regional or national residual or production mix</td>
<td>Use national residual mix if available</td>
<td>Use European production mix</td>
<td>Use national production mix</td>
<td>Treat as &quot;unknown origin&quot;</td>
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<td>No.</td>
<td>Descriptor</td>
<td>comment</td>
<td>State A</td>
<td>State B</td>
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<td>Explanations</td>
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<td>--------------</td>
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<tr>
<td>A.8.2</td>
<td>Handling of exports</td>
<td>(note)</td>
<td>Exports must be associated with explicit tracking information</td>
<td>Explicit tracking optional, otherwise use standard implicit tracking information</td>
<td>Use standard implicit tracking information</td>
<td>Default value different to the standard implicit tracking information</td>
<td>No regulation</td>
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<td>A.8.2.1</td>
<td>Accounting of exported attributes</td>
<td></td>
<td>Exported attributes are recorded and must be deducted from exporter's attribute account</td>
<td>Exports of attributes are not accounted for</td>
<td>Use internal &quot;exchange mix&quot;</td>
<td>Use statistical average used for implicit tracking</td>
<td>Treat as &quot;unknown origin&quot;</td>
<td></td>
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<tr>
<td>A.8.3</td>
<td>Handling of power exchange transactions without explicit tracking</td>
<td></td>
<td>Power exchange could also set up e.g. a hydro exchange</td>
<td>Use certificates</td>
<td>Use internal &quot;exchange mix&quot;</td>
<td>Treat as &quot;unknown origin&quot;</td>
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<tr>
<td>A.8.4</td>
<td>Handling of system losses</td>
<td></td>
<td>Default reduction factor for explicit tracking</td>
<td>Covered by implicit tracking (default)</td>
<td>Ignored</td>
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<tr>
<td>A.8.5</td>
<td>Handling of balancing power</td>
<td></td>
<td>Use certificates</td>
<td>Linked to statistical average used for implicit tracking</td>
<td>Ignored</td>
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<tr>
<td>A.9</td>
<td>Measures for regional balancing of physical energy and attributes</td>
<td></td>
<td>Joint residual mix for all participating countries</td>
<td>Ex/Imports must be balanced (either attributes plus power or swap in attributes)</td>
<td>None</td>
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</table>

### B. Tracked information

<table>
<thead>
<tr>
<th>B.1</th>
<th>Qualification as GO</th>
<th></th>
<th>RES and CHP</th>
<th>Only RES</th>
<th>Only CHP</th>
<th>No information</th>
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<tbody>
<tr>
<td>B.2</td>
<td>Production period</td>
<td></td>
<td>Mandatory, standardised production periods</td>
<td>Mandatory, no standardised production periods</td>
<td>Optional</td>
<td>No information</td>
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<td>B.3</td>
<td>Issuing date of accounting unit</td>
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<td>Mandatory</td>
<td>Optional</td>
<td>No information</td>
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<td>B.4</td>
<td>Energy sources</td>
<td></td>
<td>Detailed list of standard sources (coal, gas, nuclear etc.)</td>
<td>Standard clusters (e.g. nuclear, renewables, fossil&amp;other)</td>
<td>No standardisation</td>
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<tr>
<td>B.5</td>
<td>Qualification for high-efficiency CHP</td>
<td></td>
<td>Mandatory</td>
<td>Optional</td>
<td>No</td>
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<tr>
<td>B.5.1</td>
<td>Basis for qualification of HE CHP</td>
<td></td>
<td>Based on CHP Directive</td>
<td>Other criteria</td>
<td>Not applicable</td>
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<tr>
<td>B.6</td>
<td>Support</td>
<td></td>
<td>Support log, listing all relevant support</td>
<td>Earmark (y/n) for &quot;major&quot; support</td>
<td>No support information</td>
<td></td>
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<tr>
<td>B.7</td>
<td>RES-E/HE-CHP target</td>
<td></td>
<td>On EU level only relevant for RES-E</td>
<td>RES and CHP</td>
<td>Only RES</td>
<td>Only CHP</td>
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<tr>
<td>B.8</td>
<td>Environmental indicators</td>
<td></td>
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## E-TRACK Scenarios

### Scenario: (Template)

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<th>State D</th>
<th>State E</th>
<th>Explanations</th>
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</thead>
<tbody>
<tr>
<td>B.8.1</td>
<td>CO2 emissions</td>
<td>GHG (CO2 equivalents) neglected here</td>
<td>Plant-specific emissions recorded</td>
<td>Plant-specific combination of high/low emission attributes</td>
<td>Emissions of plant type</td>
<td>No CO2 information</td>
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<td>B.8.2</td>
<td>Nuclear waste</td>
<td>Plant-specific waste production recorded</td>
<td>Plant-specific combination of high/low waste production attributes</td>
<td>Waste production of plant type</td>
<td>No nuclear waste information</td>
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<tr>
<td>B.8.3</td>
<td>Other</td>
<td>SOx, NOx, dust etc.</td>
<td>Additional envir. indicators included</td>
<td>No inclusion of add. envir. indicators</td>
<td></td>
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<tr>
<td>B.8.4</td>
<td>Basis of environmental indicators</td>
<td>Full upstream process chain analysis</td>
<td>Standardised factors for impact of upstream process chain</td>
<td>Only direct emissions, no process chain analysis</td>
<td></td>
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<tr>
<td>B.9</td>
<td>Specific information for quality labels</td>
<td>E.g. EUGENE eligibility and additionality info</td>
<td>Mandatory, standardised</td>
<td>Optional, standardised</td>
<td>Optional, not standardised</td>
<td>No</td>
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</tr>
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</table>

### C. Uses of tracking

| C.1 | Tracking system used for disclosure | Mandatory | Optional | No |
| C.2 | Tracking system used for green power market | Mandatory | Optional | No |
| C.3.1 | Tracking system and support schemes | For RES-E, CHP etc. | Support facilitated through tracking scheme | Support facilitated by a separate tracking scheme | No tracking for support |
| C.3.2 | Facilitation of support scheme | Support recorded in tracked information | No provision of support information |
| C.4 | Transparency about support | Linked to B.6 | Verification of target fully based on tracking system | Tracking of target eligibility for exports and imports | No tracking of target information |
| C.5 | Tracking system and target accounting | Linked to B.7 | Separate accounting units for disclosure, support and target | Constraints apply to accounting units for disclosure, support and target | Single accounting unit for disclosure, support and target | Disclosure is only purpose of tracking |
| C.6 | Accounting units used for several purposes? | This relates to the "multi-certificate" discussion | Verification of target eligibility for exports and imports | No tracking of target information |

### D. Reliability and verification measures

<p>| D.1 | Independent verification of tracking results | Mandatory for all participants | Selective verification by the regulator | Verification on voluntary basis only |
| D.2 | Redemption of accounting units | Mandatory for all uses | Mandatory for disclosure only | No requirements |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Descriptor</th>
<th>comment</th>
<th>State A</th>
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<tbody>
<tr>
<td>A.1</td>
<td>Explicit tracking for non-RES-E / non-HE-CHP generation?</td>
<td></td>
<td>Mandatory for all transactions</td>
<td>Mandatory, except undisclosed imports and purchases from power exchanges</td>
<td>Mandatory for long term contracts</td>
<td>Voluntary</td>
<td>Not possible</td>
<td></td>
</tr>
<tr>
<td>A.2</td>
<td>Explicit tracking for RES-E and HE-CHP generation?</td>
<td>E.g. via GOs</td>
<td>Mandatory for RES-E and HE-CHP</td>
<td>Mandatory for part of RES-E and CHP</td>
<td>Voluntary</td>
<td>Not possible</td>
<td>only exemption: undisclosed imports and purchases from power exchanges</td>
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<tr>
<td>A.3</td>
<td>Use of standardised accounting units for explicit tracking</td>
<td>E.g. certificates, tags</td>
<td>Mandatory</td>
<td>Acc.units can be used only for the calendar year of issuing</td>
<td>Acc.units can be used longer than the calendar year of issuing</td>
<td>Unlimited</td>
<td>Never</td>
<td>Technically unlimited, but limited by regulations of tracking uses</td>
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<tr>
<td>A.3.1</td>
<td>Limited lifetime of accounting units</td>
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<td></td>
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<td></td>
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<td>A.4</td>
<td>Explicit tracking can be de-linked from electricity contracts?</td>
<td>Ex post contract tracking, e.g. as in Germany</td>
<td>Yes, standard</td>
<td>Optional</td>
<td>No</td>
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<tr>
<td>A.4.1</td>
<td>(Standard) Explicit tracking mechanism linked to balances of electricity trading?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A.6</td>
<td>Use of registries for explicit tracking</td>
<td>Unique European or national registry</td>
<td>Unique registry per country or domain</td>
<td>Several parallel registries</td>
<td>No registry available</td>
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<td></td>
<td></td>
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<tr>
<td>A.6.1</td>
<td>Type of registries</td>
<td>European (more than UCTE)</td>
<td>Transmission system, e.g. UCTE</td>
<td>Region (several countries)</td>
<td>National</td>
<td>Sub-national</td>
<td></td>
<td></td>
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<tr>
<td>A.7</td>
<td>Use of statistical averages (implicit tracking)</td>
<td>No default value available</td>
<td>Limited to certain volumes/transactions</td>
<td>Unlimited</td>
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<tr>
<td>A.7.1</td>
<td>Limitation of total share of statistical averages within portfolio?</td>
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<td></td>
<td>Unlimited</td>
<td>Limited to a certain share</td>
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<td>A.7.2</td>
<td>Limitation of use of statistical averages for certain transactions?</td>
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<td></td>
<td>Unlimited</td>
<td>Limitation for certain transactions</td>
<td></td>
<td></td>
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<tr>
<td>A.7.3</td>
<td>Type of statistical average used</td>
<td>European (more than UCTE)</td>
<td>Other forms of correction by attributes being tracked explicitly</td>
<td>Other forms of correction by attributes being tracked explicitly</td>
<td>Correlation feasible e.g. in a joint (nordic) market; usually probably no information on international residual mix is available</td>
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<td>A.7.4</td>
<td>Correction by attributes tracked explicitly</td>
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<td>Other forms of correction by attributes being tracked explicitly</td>
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<tr>
<td>A.8</td>
<td>Handling of specific &quot;low-information&quot; processes</td>
<td>Rating according to descriptors A.8.1 to A.8.5</td>
<td>Ambitious approach</td>
<td>Moderate approach</td>
<td>Less ambitious approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8.1</td>
<td>Handling of imports without explicit tracking</td>
<td>Use regional or national residual or production mix</td>
<td>Use national residual mix if available</td>
<td>Use European production mix</td>
<td>Use national production mix</td>
<td>Treat as &quot;unknown origin&quot;</td>
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<td>A.8.2</td>
<td>Handling of exports</td>
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**E-TRACK scenarios (v.18) Option 0**

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**List of Descriptors**

*Date: 13.10.2006*
<table>
<thead>
<tr>
<th>No.</th>
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<tr>
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<td>Exported attributes are recorded and must be deducted from exporter's attribute account</td>
<td>Exports of attributes are not accounted for</td>
<td>No regulation</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>A.8.3</td>
<td>Handling of power exchange transactions without explicit tracking</td>
<td>Power exchange could also set up e.g. a hydro exchange</td>
<td>Use certificates</td>
<td>Use internal “exchange mix”</td>
<td>Use statistical average used for implicit tracking</td>
<td>Treat as “unknown origin”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.9</td>
<td>Measures for regional balancing of physical energy and attributes</td>
<td>Joint residual mix for all participating countries</td>
<td>Ex/Imports must be balanced (either attributes plus power or swap in attributes)</td>
<td>none</td>
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</table>

### B. Tracked information

<table>
<thead>
<tr>
<th>B.1</th>
<th>Qualification as GO</th>
<th>Do accounting units specify whether they qualify as GO?</th>
<th>RES and CHP</th>
<th>Only RES</th>
<th>Only CHP</th>
<th>No information</th>
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<tbody>
<tr>
<td>B.2</td>
<td>Production period</td>
<td>Mandatory, standardised production periods</td>
<td>Mandatory, no standardised production periods</td>
<td>Optional</td>
<td>No information</td>
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<tr>
<td>B.3</td>
<td>Issuing date of accounting unit</td>
<td>Mandatory</td>
<td>Optional</td>
<td>No information</td>
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<tr>
<td>B.4</td>
<td>Energy sources</td>
<td>Detailed list of standard sources (coal, gas, nuclear etc.)</td>
<td>Standard clusters (e.g. nuclear, renewables, fossil&amp;other)</td>
<td>No standardisation</td>
<td></td>
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</tr>
<tr>
<td>B.5</td>
<td>Qualification for high-efficiency CHP</td>
<td>Mandatory</td>
<td>Optional</td>
<td>No</td>
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<td></td>
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<tr>
<td>B.5.1</td>
<td>Basis for qualification of HE CHP</td>
<td>Based on CHP Directive</td>
<td>Other criteria</td>
<td>Not applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.6</td>
<td>Support</td>
<td>Support log, listing all relevant support</td>
<td>“Earmark (y/n)” for “major” support</td>
<td>No support information</td>
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<tr>
<td>B.7</td>
<td>RES-E/HE-CHP target</td>
<td>On EU level only relevant for RES-E</td>
<td>RES and CHP</td>
<td>Only RES</td>
<td>Only CHP</td>
<td>No information</td>
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<tr>
<td>B.8</td>
<td>Environmental indicators</td>
<td>GHG (CO2 equivalents) neglected here</td>
<td>Plant-specific emissions recorded</td>
<td>Plant-specific combination of high/low emission attributes</td>
<td>Emissions of plant type</td>
<td>No CO2 information</td>
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<td>B.8.1</td>
<td>CO2 emissions</td>
<td>GHG (CO2 equivalents) neglected here</td>
<td>Plant-specific emissions recorded</td>
<td>Plant-specific combination of high/low emission attributes</td>
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<tr>
<td>B.8.2</td>
<td>Nuclear waste</td>
<td>Plant-specific waste production recorded</td>
<td>Plant-specific combination of high/low waste production attributes</td>
<td>Waste production of plant type</td>
<td>No nuclear waste information</td>
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</tr>
<tr>
<td>B.8.3</td>
<td>Other</td>
<td>SOx, NOx, dust etc.</td>
<td>Additional envir. Indicators included</td>
<td>No inclusion of add. envir. indicators</td>
<td></td>
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</tbody>
</table>
### List of Descriptors

**Scenario: Option 0**

**“Contract based system”**

**Date: 13.10.2006**

<table>
<thead>
<tr>
<th>No.</th>
<th>Descriptor</th>
<th>comment</th>
<th>State A</th>
<th>State B</th>
<th>State C</th>
<th>State D</th>
<th>State E</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.8.4</td>
<td>Basis of environmental indicators</td>
<td>Full upstream process chain analysis</td>
<td>Standardised factors for impact of upstream process chain</td>
<td>Only direct emissions, no process chain analysis</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.9</td>
<td>Specific information for quality labels</td>
<td>E.g. EUGENE eligibility and additonal info</td>
<td>Mandatory, standardised</td>
<td>Optional, standardised</td>
<td>Optional, not standardised</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### C. Uses of tracking

| C.1  | Tracking system used for disclosure           | Mandatory                                    | Optional                     | No                            |                                  |                                  |                                  |              |
| C.2  | Tracking system used for green power market   | Mandatory                                    | Optional                     | No                            |                                  |                                  |                                  |              |
| C.3  | Tracking system and support schemes           | For RES-E, CHP etc.                          |                              |                               |                                  |                                  |                                  |              |
| C.3.1 | Facilitation of support scheme                | Support facilitated through tracking scheme | Support facilitated by a separate tracking scheme | No tracking for support |                                  |                                  |                                  |              |
| C.3.2 | Transparency about support                    | Linked to B.6                                | Support recorded in tracked information | No provision of support information |                              |                                  |                                  |              |
| C.4  | Tracking system and target accounting         | Linked to B.7                                | Verification of target eligibility for imports | Tracking of target information | No tracking of target information |                                  |                                  |              |
| C.5  | Accounting units used for several purposes?   | This relates to the "multi-certificate" discussion | Separate accounting units for disclosure, support and target | Constraints apply to accounting units for disclosure, support and target | Single accounting unit for disclosure, support and target | Disclosure is only purpose of tracking |                                  |              |

#### D. Reliability and verification measures

<p>| D.1  | Independent verification of tracking results | Mandatory for all participants | Selective verification by the regulator | Verification on voluntary basis only |                                  |                                  |                                  |              |
| D.2  | Redemption of accounting units                | Mandatory for all uses | No requirements |                                  |                                  |                                  |                                  |              |</p>
<table>
<thead>
<tr>
<th>No.</th>
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<th>comment</th>
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<th>State D</th>
<th>State E</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Explicit tracking for non-RES-E / non-HE-CHP generation?</td>
<td></td>
<td>Mandatory for all transactions</td>
<td>Mandatory, except undisclosed imports and purchases from power exchanges</td>
<td>Mandatory for long term contracts</td>
<td>Voluntary</td>
<td>Not possible</td>
<td></td>
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<tr>
<td>A.2</td>
<td>Explicit tracking for RES-E and HE-CHP generation?</td>
<td>E.g. via GOs</td>
<td>Mandatory for RES-E and HE-CHP</td>
<td>Mandatory for part of RES-E and CHP</td>
<td>Voluntary</td>
<td>Not possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3</td>
<td>Use of standardised accounting units for explicit tracking</td>
<td></td>
<td>Acc. units can be used only for the calendar year of issuing</td>
<td>Acc. units can be used longer than the calendar year of issuing</td>
<td>Unlimited</td>
<td></td>
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<tr>
<td>A.3.1</td>
<td>Limited lifetime of accounting units</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Technically unlimited, but limited by regulations of tracking uses</td>
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<tr>
<td>A.4</td>
<td>Explicit tracking can be de-linked from electricity contracts?</td>
<td></td>
<td>Yes, standard</td>
<td>Optional</td>
<td>Not possible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4.1</td>
<td>(Standard) Explicit tracking mechanism linked to balances of electricity trading?</td>
<td>Ex post contract tracking, e.g. as in Germany</td>
<td>Yes, standard</td>
<td>Optional</td>
<td>No</td>
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</tr>
<tr>
<td>A.6</td>
<td>Use of registries for explicit tracking</td>
<td></td>
<td>Mandatory for all explicit tracking</td>
<td>Optional</td>
<td>No registry available</td>
<td></td>
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<tr>
<td>A.6.1</td>
<td>Type of registries</td>
<td></td>
<td>Unique European registry</td>
<td>Unique registry per country or domain</td>
<td>Several parallel registries</td>
<td>No registry</td>
<td></td>
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<tr>
<td>A.7</td>
<td>Use of statistical averages (implicit tracking)</td>
<td>(Note)</td>
<td>No default value available</td>
<td>Limited to certain volumes/transactions</td>
<td>Unlimited</td>
<td></td>
<td></td>
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<tr>
<td>A.7.1</td>
<td>Limitation of total share of statistical averages within portfolio?</td>
<td></td>
<td>Unlimited</td>
<td>Limited to a certain share</td>
<td>Unlimited</td>
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<td></td>
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<tr>
<td>A.7.2</td>
<td>Limitation of use of statistical averages for certain transactions?</td>
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<td>Unlimited</td>
<td>Limitation for certain transactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A.7.3</td>
<td>Type of statistical average used</td>
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<td>European (more than UCTE)</td>
<td>Transmission system, e.g. UCTE</td>
<td>Region (several countries)</td>
<td>National</td>
<td>Sub-national</td>
<td></td>
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<tr>
<td>A.7.4</td>
<td>Correction by attributes tracked explicitly</td>
<td></td>
<td>Unused certificates are collected for the residual mix and redeemed</td>
<td>Other forms of correction by all attributes being tracked explicitly</td>
<td>Other forms of correction by part of the attributes being tracked explicitly</td>
<td>No correction</td>
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</tr>
<tr>
<td>A.8</td>
<td>Handling of specific &quot;low-information&quot; processes</td>
<td></td>
<td>Rating according to descriptors A.8.1 to A.8.5</td>
<td>Ambitious approach</td>
<td>Moderate approach</td>
<td>Less ambitious approach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8.1</td>
<td>Handling of imports without explicit tracking</td>
<td>(note)</td>
<td>Use regional or national residual production mix</td>
<td>Use national residual mix if available</td>
<td>Use European production mix</td>
<td>Use national production mix</td>
<td>Default value different to the standard implicit tracking information</td>
<td></td>
</tr>
<tr>
<td>A.8.2</td>
<td>Handling of exports</td>
<td>(note)</td>
<td>Exports must be associated with explicit tracking information</td>
<td>Explicit tracking optional, otherwise use standard implicit tracking information</td>
<td>Use standard implicit tracking information</td>
<td>No regulation</td>
<td></td>
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</tbody>
</table>
### E-TRACK Scenarios

**Scenario:** Option A  
**"Ex post contract tracking"**

#### List of Descriptors

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<thead>
<tr>
<th>No.</th>
<th>Descriptor</th>
<th>comment</th>
<th>State A</th>
<th>State B</th>
<th>State C</th>
<th>State D</th>
<th>State E</th>
<th>Explanations</th>
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</thead>
<tbody>
<tr>
<td>A.8.2.1</td>
<td>Accounting of exported attributes</td>
<td>Exported attributes are recorded and must be deducted from exporter’s attribute account</td>
<td>Exports of attributes are not accounted for</td>
<td>No regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8.3</td>
<td>Handling of power exchange transactions without explicit tracking</td>
<td>Power exchange could also set up e.g. a hydro exchange</td>
<td>Use certificates</td>
<td>Use internal “exchange mix”</td>
<td>Use statistical average used for implicit tracking</td>
<td>Treat as “unknown origin”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.9</td>
<td>Measures for regional balancing of physical energy and attributes</td>
<td>Joint residual mix for all participating countries</td>
<td>Ex/Imports must be balanced (either attributes plus power or swap in attributes)</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

#### B. Tracked information

<table>
<thead>
<tr>
<th>B.1</th>
<th>Qualification as GO</th>
<th>Do accounting units specify whether they qualify as GO?</th>
<th>RES and CHP</th>
<th>Only RES</th>
<th>Only CHP</th>
<th>No information</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.2</td>
<td>Production period</td>
<td>Mandatory, standardised production periods</td>
<td>Mandatory, no standardised production periods</td>
<td>Optional</td>
<td>No information</td>
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<tr>
<td>B.3</td>
<td>Issuing date of accounting unit</td>
<td>Mandatory</td>
<td>Optional</td>
<td>No information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.4</td>
<td>Energy sources</td>
<td>Detailed list of standard sources (coal, gas, nuclear etc.)</td>
<td>Standard clusters (e.g. nuclear, renewables, fossil&amp;other)</td>
<td>No standardisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.5</td>
<td>Qualification for high-efficiency CHP</td>
<td>Mandatory</td>
<td>Optional</td>
<td>No</td>
<td></td>
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<tr>
<td>B.5.1</td>
<td>Basis for qualification of HE CHP</td>
<td>Based on CHP Directive</td>
<td>Other criteria</td>
<td>Not applicable</td>
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<tr>
<td>B.6</td>
<td>Support</td>
<td>Support log, listing all relevant support</td>
<td>Categorise (yn) for “major” support</td>
<td>No support information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.7</td>
<td>RES-E/HE-CHP target</td>
<td>On EU level only relevant for RES-E</td>
<td>RES and CHP</td>
<td>Only RES</td>
<td>Only CHP</td>
<td>No information</td>
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<tr>
<td>B.8</td>
<td>Environmental indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| B.8.1 | CO2 emissions | GHG (CO2 equivalents) neglected here | Plant-specific emissions recorded | Plant-specific combination of high/low emission attributes | Emissions of plant type | No CO2 information |
| B.8.2 | Nuclear waste | Plant-specific waste production recorded | Plant-specific combination of high/low waste production attributes | Waste production of plant type | No nuclear waste information |
| B.8.3 | Other | SOx, NOx, dust etc. | Additional envr. Indicators included | No inclusion of add. envr. indicators |

---

E-TRACK scenarios (v.18) ! Option A  
Page 8  
Date: 13.11.2006
**E-TRACK Scenarios**  
**Scenario:** Option A  
**"Ex post contract tracking"**

### List of Descriptors  
**Date:** 13.10.2006

<table>
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<tr>
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<th>State D</th>
<th>State E</th>
<th>Explanations</th>
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</thead>
<tbody>
<tr>
<td>B.8.4</td>
<td>Basis of environmental indicators</td>
<td>Full upstream process chain analysis</td>
<td>Standardised factors for impact of upstream process chain</td>
<td>Only direct emissions, no process chain analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.9</td>
<td>Specific information for quality labels</td>
<td>E.g. EUGENE eligibility and additionality info</td>
<td>Mandatory, standardised</td>
<td>Optional, standardised</td>
<td>Optional, not standardised</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### C. Uses of tracking

| C.1 | Tracking system used for disclosure | Mandatory | Optional | No |
| C.2 | Tracking system used for green power market | Mandatory | Optional | No |
| C.3 | Tracking system and support schemes | Support facilitated through tracking scheme | Support facilitated by a separate tracking scheme | No tracking for support |
| C.3.1 | Facilitation of support scheme | Support recorded in tracked information | No provision of support information |
| C.3.2 | Transparency about support | Linked to B.6 | Verification of target fully based on tracking system | Tracking of target eligibility for exports and imports | No tracking of target information |
| C.4 | Tracking system and target accounting | Linked to B.7 | Separate accounting units for disclosure, support and target | Constraints apply to accounting units for disclosure, support and target | Single accounting unit for disclosure, support and target | Disclosure is only purpose of tracking |
| C.5 | Accounting units used for several purposes? | This relates to the "multi-certificate" discussion | Separate accounting units for disclosure, support and target | Constraints apply to accounting units for disclosure, support and target | Single accounting unit for disclosure, support and target | Disclosure is only purpose of tracking |

### D. Reliability and verification measures

| D.1 | Independent verification of tracking results | Mandatory for all participants | Selective verification by the regulator | Verification on voluntary basis only |
| D.2 | Redemption of accounting units | Mandatory for all uses | Mandatory only | No requirements |
### E-TRACK Scenarios

**Scenario:** Option B

**"Voluntary certificate system plus residual mix"**

<table>
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<tr>
<th>No.</th>
<th>Descriptor</th>
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<th>State A</th>
<th>State B</th>
<th>State C</th>
<th>State D</th>
<th>State E</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Explicit tracking for non-RES-E / non-HE-CHP generation?</td>
<td>Mandatory for all transactions</td>
<td>Mandatory, except undisclosed imports and purchases from power exchanges</td>
<td>Mandatory for long term contracts</td>
<td>Voluntary</td>
<td>Not possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.2</td>
<td>Explicit tracking for RES-E and HE-CHP generation?</td>
<td>E.g. via GOs</td>
<td>Mandatory for RES-E and HE-CHP</td>
<td>Mandatory for part of RES-E and CHP</td>
<td>Voluntary</td>
<td>Not possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3</td>
<td>Use of standardised accounting units for explicit tracking</td>
<td>E.g. certificates, tags</td>
<td>Mandatory</td>
<td>Optional</td>
<td>Never</td>
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<tr>
<td>A.3.1</td>
<td>Limited lifetime of accounting units</td>
<td>Acc. units can be used only for the calendar year of issuing</td>
<td>Acc. units can be used longer than the calendar year of issuing</td>
<td>Unlimited</td>
<td>Technically unlimited, but limited by regulations of tracking uses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4</td>
<td>Explicit tracking can be de-linked from electricity contracts?</td>
<td>Yes, standard</td>
<td>Optional</td>
<td>Not possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4.1</td>
<td>(Standard) Explicit tracking mechanism linked to balances of electricity trading?</td>
<td>Yes post contract tracking, e.g. as in Germany</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.6</td>
<td>Use of registries for explicit tracking</td>
<td>Mandatory for all explicit tracking</td>
<td>Optional</td>
<td>No registry available</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.6.1</td>
<td>Type of registries</td>
<td>Unique European registry</td>
<td>Unique registry per country or domain</td>
<td>Several parallel registries</td>
<td>No registry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7</td>
<td>Use of statistical averages (implicit tracking)</td>
<td>No default value available</td>
<td>Limited to certain volumes/transactions</td>
<td>Unlimited</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7.1</td>
<td>Limitation of total share of statistical averages within portfolio?</td>
<td>Unlimited</td>
<td>Limited to a certain share</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>A.7.2</td>
<td>Limitation of use of statistical averages for certain transactions?</td>
<td>Unlimited</td>
<td>Limitation for certain transactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7.3</td>
<td>Type of statistical average used</td>
<td>European (more than UCTE)</td>
<td>Transmission system, e.g. UCTE</td>
<td>Region (several countries)</td>
<td>National</td>
<td>Sub-national</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7.4</td>
<td>Correction by attributes tracked explicitly</td>
<td>Corrections result in a residual mix</td>
<td>Unused certificates are collected for the residual mix and redeemed</td>
<td>Other forms of correction by all attributes being tracked explicitly</td>
<td>Other forms of correction by part of the attributes being tracked explicitly</td>
<td>No correction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8</td>
<td>Handling of specific &quot;low-information&quot; processes</td>
<td>Rating according to descriptors A.8.1 to A.8.5</td>
<td>Ambitious approach</td>
<td>Moderate approach</td>
<td>Less ambitious approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8.1</td>
<td>Handling of imports without explicit tracking</td>
<td>(note)</td>
<td>use regional or national residual or production mix</td>
<td>Use national residual mix if available</td>
<td>Use European production mix</td>
<td>Use national production mix</td>
<td>&quot;Treat as &quot;unknown origin&quot;</td>
<td></td>
</tr>
<tr>
<td>A.8.2</td>
<td>Handling of exports</td>
<td>(note)</td>
<td>Exports must be associated with explicit tracking information</td>
<td>Explicit tracking optional, otherwise use standard implicit tracking information</td>
<td>Use standard implicit tracking information</td>
<td>Default value different to the standard implicit tracking information</td>
<td>No regulation</td>
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## E-TRACK Scenarios

**Scenario:** Option B  
**"Voluntary certificate system plus residual mix"**

### List of Descriptors 13.10.2006

<table>
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<tr>
<th>No.</th>
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<th>State E</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.8.2.1</td>
<td>Accounting of exported attributes</td>
<td>Exported attributes are recorded and must be deducted from exporter's attribute account</td>
<td>Exports of attributes are not accounted for</td>
<td>No regulation</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A.8.3</td>
<td>Handling of power exchange transactions without explicit tracking</td>
<td>Power exchange could also set up e.g. a hydro exchange</td>
<td>Use certificates</td>
<td>Use internal &quot;exchange mix&quot;</td>
<td>Use statistical average</td>
<td>Treat as &quot;unknown origin&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.9</td>
<td>Measures for regional balancing of physical energy and attributes</td>
<td>Joint residual mix for all participating countries</td>
<td>Ex/Imports must be balanced (either attributes plus power or swap in attributes)</td>
<td>none</td>
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### B. Tracked information

<table>
<thead>
<tr>
<th>B.1</th>
<th>Qualification as GO</th>
<th>Do accounting units specify whether they qualify as GO?</th>
<th>RES and CHP</th>
<th>Only RES</th>
<th>Only CHP</th>
<th>No information</th>
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</thead>
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<tr>
<td>B.2</td>
<td>Production period</td>
<td>Mandatory, standardised production periods</td>
<td>Mandatory, no standardised production periods</td>
<td>Optional</td>
<td>No information</td>
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<tr>
<td>B.3</td>
<td>Issuing date of accounting unit</td>
<td>Mandatory</td>
<td>Optional</td>
<td>No information</td>
<td></td>
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</tr>
<tr>
<td>B.4</td>
<td>Energy sources</td>
<td>Detailed list of standard sources</td>
<td>Standard clusters (e.g. nuclear, renewables, fossil&amp;other)</td>
<td>No standardisation</td>
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<td></td>
</tr>
<tr>
<td>B.5</td>
<td>Qualification for high-efficiency CHP</td>
<td>Mandatory</td>
<td>Optional</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.5.1</td>
<td>Basis for qualification of HE CHP</td>
<td>Based on CHP Directive</td>
<td>Other criteria</td>
<td>Not applicable</td>
<td></td>
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</tr>
<tr>
<td>B.6</td>
<td>Support</td>
<td>Support log, listing all relevant support</td>
<td>&quot;major&quot; support</td>
<td>No support information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.7</td>
<td>RES-E/HE-CHP target</td>
<td>On EU level only relevant for RES-E</td>
<td>RES and CHP</td>
<td>Only RES</td>
<td>Only CHP</td>
<td>No information</td>
</tr>
<tr>
<td>B.8</td>
<td>Environmental indicators</td>
<td><strong>GHE (CO2 equivalents) neglected here</strong></td>
<td>Plant-specific emissions recorded</td>
<td>Plant-specific combination of high/low emission attributes</td>
<td>Plant-specific combination of high/low waste production attributes</td>
<td>Plant-specific combination of high/low waste production attributes</td>
</tr>
<tr>
<td>B.8.1</td>
<td>CO2 emissions</td>
<td><strong>GHG (CO2 equivalents) neglected here</strong></td>
<td>Plant-specific emissions recorded</td>
<td>Plant-specific combination of high/low emission attributes</td>
<td>Plant-specific combination of high/low waste production attributes</td>
<td>Waste production of plant type</td>
</tr>
<tr>
<td>B.8.2</td>
<td>Nuclear waste</td>
<td><strong>Plant-specific waste production recorded</strong></td>
<td>Plant-specific combination of high/low waste production attributes</td>
<td>Waste production of plant type</td>
<td>No nuclear waste information</td>
<td></td>
</tr>
<tr>
<td>B.8.3</td>
<td>Other</td>
<td><strong>SOx, NOx, dust etc.</strong></td>
<td>Additional envir. Indicators included</td>
<td>No inclusion of add. envir. indicators</td>
<td></td>
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</table>
### E-TRACK Scenarios

**Scenario:** Option B  
**“Voluntary certificate system plus residual mix”**

**List of Descriptors**  
13.10.2006

<table>
<thead>
<tr>
<th>No.</th>
<th>Descriptor</th>
<th>comment</th>
<th>State A</th>
<th>State B</th>
<th>State C</th>
<th>State D</th>
<th>State E</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.8.4</td>
<td>Basis of environmental indicators</td>
<td>Full upstream process chain analysis</td>
<td>Standardised factors for impact of upstream process chain</td>
<td>Only direct emissions, no process chain analysis</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.9</td>
<td>Specific information for quality labels</td>
<td>E.g. EUGENE eligibility and additionality info</td>
<td>Mandatory, standardised</td>
<td>Optional, standardised</td>
<td>Optional, not standardised</td>
<td>No</td>
<td></td>
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</tr>
</tbody>
</table>

**C. Uses of tracking**

| C.1 | Tracking system used for disclosure | Mandatory | Optional | No |
| C.2 | Tracking system used for green power market | Mandatory | Optional | No |

**C.3 Tracking system and support schemes**  
For RES-E, CHP etc.

| C.3.1 | Facilitation of support scheme | Support facilitated through tracking scheme | Support facilitated by a separate tracking scheme | No tracking for support |
| C.3.2 | Transparency about support | Linked to B.6 | Support recorded in tracked information | No provision of support information |
| C.4 | Tracking system and target accounting | Linked to B.7 | Verification of target eligibility for exports and imports | No tracking of target information |

**C.5 Accounting units used for several purposes?**  
This relates to the "multi-certificate" discussion

| C.5.1 | Separate accounting units for disclosure, support and target | Constraints apply to accounting units for disclosure, support and target | Single accounting unit for disclosure, support and target | Disclosure is only purpose of tracking |

**D. Reliability and verification measures**

| D.1 | Independent verification of tracking results | Mandatory for all participants | Selective verification by the regulator | Verification on voluntary basis only |
| D.2 | Redemption of accounting units | Mandatory for all uses | Mandatory for disclosure only | No requirements |
### E-TRACK Scenarios

**Scenario:** Option C

*"Ambitious certificate system plus residual mix"*

**List of Descriptors**

<table>
<thead>
<tr>
<th>No.</th>
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<th>State A</th>
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<th>State C</th>
<th>State D</th>
<th>State E</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.1</td>
<td>Explicit tracking for non-RES-E / non-HE-CHP generation?</td>
<td>Mandatory for all transactions</td>
<td>Mandatory, except undisclosed imports and purchases from power exchanges</td>
<td>Mandatory for long term contracts</td>
<td>Voluntary</td>
<td>Not possible</td>
<td>Mandatory except for undisclosed imports</td>
<td></td>
</tr>
<tr>
<td>A.2</td>
<td>Explicit tracking for RES-E and HE-CHP generation?</td>
<td>E.g. via GOs</td>
<td>Mandatory for RES-E and HE-CHP</td>
<td>Mandatory for part of RES-E and CHP</td>
<td>Voluntary</td>
<td>Not possible</td>
<td></td>
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<tr>
<td>A.3</td>
<td>Use of standardised accounting units for explicit tracking</td>
<td>E.g. certificates, tags</td>
<td>Mandatory</td>
<td>Optional</td>
<td>Never</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3.1</td>
<td>Limited lifetime of accounting units</td>
<td>Acc. units can be used only for the calendar year of issuing</td>
<td>Acc. units can be used longer than the calendar year of issuing</td>
<td>Unlimited</td>
<td>Technically unlimited, but limited by regulations of tracking uses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4</td>
<td>Explicit tracking can be de-linked from electricity contracts?</td>
<td>Yes, standard</td>
<td>Optional</td>
<td>Not possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4.1</td>
<td>Ex post contract tracking, e.g. as in Germany</td>
<td>Yes</td>
<td>Optional</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.6</td>
<td>Use of registries for explicit tracking</td>
<td>Mandatory for all explicit tracking</td>
<td>Optional</td>
<td>No registry available</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.6.1</td>
<td>Type of registries</td>
<td>Unique European registry</td>
<td>Unique registry per country or domain</td>
<td>Several parallel registries</td>
<td>No registry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7</td>
<td>Use of statistical averages (implicit tracking)</td>
<td>(Note)</td>
<td>No default value available</td>
<td>Limited to certain volumes/transactions</td>
<td>Unlimited</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A.7.1</td>
<td>Limitation of total share of statistical averages within portfolio?</td>
<td>Unlimited</td>
<td>Limited to a certain share</td>
<td>not generally limited but generally only accepted in exceptional cases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.7.2</td>
<td>Limitation of use of statistical averages for certain transactions?</td>
<td>Unlimited</td>
<td>Limitation for certain transactions</td>
<td>not generally limited but generally only accepted in exceptional cases</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>A.7.3</td>
<td>Type of statistical average used</td>
<td>European (more than UCTE)</td>
<td>Transmission system, e.g. UCTE</td>
<td>Region (several countries)</td>
<td>National</td>
<td>Sub-national</td>
<td></td>
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<tr>
<td>A.7.4</td>
<td>Correction by attributes tracked explicitly</td>
<td>Corrections result in a residual mix</td>
<td>Unused certificates are collected for the residual mix and redeemed</td>
<td>Other forms of correction by all attributes being tracked explicitly</td>
<td>Other forms of correction by part of the attributes being tracked explicitly</td>
<td>No correction</td>
<td></td>
<td></td>
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<tr>
<td>A.8</td>
<td>Handling of specific &quot;low-information&quot; processes</td>
<td>Rating according to descriptors A.8.1 to A.8.6</td>
<td>Ambitious approach</td>
<td>Moderate approach</td>
<td>Less ambitious approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8.1</td>
<td>Handling of imports without explicit tracking</td>
<td>Use regional or national residual or production mix</td>
<td>Use national residual mix if available</td>
<td>Use European production mix</td>
<td>Use national production mix</td>
<td>Treat as &quot;unknown origin&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.8.2</td>
<td>Handling of exports</td>
<td>Exports must be associated with explicit tracking information</td>
<td>Explicit tracking, otherwise use standard implicit tracking information</td>
<td>Use standard implicit tracking information</td>
<td>Default value different to the standard implicit tracking information</td>
<td>No regulation</td>
<td></td>
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</tr>
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</table>
### E-TRACK Scenarios

**Scenario:** Option C  
**“Ambitious certificate system plus residual mix”**

#### List of Descriptors  13.10.2006

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</tr>
</thead>
<tbody>
<tr>
<td>A.8.2.1</td>
<td>Accounting of exported attributes</td>
<td>Exported attributes are recorded and must be deducted from exporter's attribute account</td>
<td>Exports of attributes are not accounted for</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No regulation</td>
</tr>
<tr>
<td>A.8.3</td>
<td>Handling of power exchange transactions without explicit tracking</td>
<td>Power exchange could also set up e.g. a hydro exchange</td>
<td>Use certificates</td>
<td>Use internal &quot;exchange mix&quot;</td>
<td>Use statistical average used for implicit tracking</td>
<td></td>
<td></td>
<td>Treat as &quot;unknown origin&quot;</td>
</tr>
<tr>
<td>A.9</td>
<td>Measures for regional balancing of physical energy and attributes</td>
<td>Joint residual mix for all participating countries</td>
<td>Ex/Imports must be balanced (either attributes plus power or swap in attributes)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>none</td>
</tr>
</tbody>
</table>

#### B. Tracked Information

<table>
<thead>
<tr>
<th>B.1</th>
<th>Qualification as GO</th>
<th>Do accounting units specify whether they qualify as GO?</th>
<th>RES and CHP</th>
<th>Only RES</th>
<th>Only CHP</th>
<th>No information</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.2</td>
<td>Production period</td>
<td>Mandatory, standardised production periods</td>
<td>Mandatory, no standardised production periods</td>
<td>Optional</td>
<td></td>
<td>No information</td>
</tr>
<tr>
<td>B.3</td>
<td>Issuing date of accounting unit</td>
<td>Mandatory</td>
<td>Optional</td>
<td></td>
<td></td>
<td>No information</td>
</tr>
<tr>
<td>B.4</td>
<td>Energy sources</td>
<td>Detailed list of standard sources (coal, gas, nuclear etc.)</td>
<td>Standard clusters (e.g. nuclear, renewables, fossil&amp;other)</td>
<td></td>
<td></td>
<td>No standardisation</td>
</tr>
<tr>
<td>B.5</td>
<td>Qualification for high-efficiency CHP</td>
<td>Mandatory</td>
<td>Optional</td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>B.5.1</td>
<td>Basis for qualification of HE CHP</td>
<td>Based on CHP Directive</td>
<td>Other criteria</td>
<td></td>
<td></td>
<td>Not applicable</td>
</tr>
<tr>
<td>B.6</td>
<td>Support</td>
<td>Support log, listing all relevant support</td>
<td>earmark (y/n) for &quot;major&quot; support</td>
<td></td>
<td></td>
<td>No support information</td>
</tr>
<tr>
<td>B.7</td>
<td>RES-E/HE-CHP target</td>
<td>On EU level only relevant for RES-E</td>
<td>RES and CHP</td>
<td>Only RES</td>
<td>Only CHP</td>
<td>No information</td>
</tr>
<tr>
<td>B.8</td>
<td>Environmental indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.8.1</td>
<td>CO2 emissions</td>
<td>GHG (CO2 equivalents) neglected here</td>
<td>Plant-specific emissions recorded</td>
<td>Plant-specific combination of high/low emission attributes</td>
<td>Emissions of plant type</td>
<td></td>
</tr>
<tr>
<td>B.8.2</td>
<td>Nuclear waste</td>
<td>Plant-specific waste production recorded</td>
<td>Plant-specific combination of high/low waste production attributes</td>
<td>Waste production of plant type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.8.3</td>
<td>Other</td>
<td>SOx, NOx, dust etc.</td>
<td>Additional envir. indicators included</td>
<td></td>
<td></td>
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</table>
### E-TRACK Scenarios

**Scenario:** Option C

**“Ambitious certificate system plus residual mix”**

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<th>Explanations</th>
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</thead>
<tbody>
<tr>
<td>B.8.4</td>
<td>Basis of environmental indicators</td>
<td>Full upstream process chain analysis</td>
<td>Standardised factors for impact of upstream process chain</td>
<td>Only direct emissions, no process chain analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.9</td>
<td>Specific information for quality labels</td>
<td>E.g. EUGENE eligibility and additionality info</td>
<td>Mandatory, standardised</td>
<td>Optional, standardised</td>
<td>Optional, not standardised</td>
<td>No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**C. Uses of tracking**

- **C.1 Tracking system used for disclosure**
  - Mandatory
  - Optional
  - No

- **C.2 Tracking system used for green power market**
  - Mandatory
  - Optional
  - No

- **C.3 Tracking system and support schemes**
  - For RES-E, CHP etc.

- **C.3.1 Facilitation of support scheme**
  - Support facilitated through tracking scheme
  - Support facilitated by a separate tracking scheme
  - No tracking for support

- **C.3.2 Transparency about support**
  - Linked to B.6
  - Support recorded in tracked information
  - No provision of support information

- **C.4 Tracking system and target accounting**
  - Linked to B.7
  - Verification of target fully based on tracking system
  - Tracking of target eligibility for exports and imports
  - No tracking of target information

- **C.5 Accounting units used for several purposes?**
  - This relates to the "multi-certificate" discussion
  - Separate accounting units for disclosure, support and target
  - Constraints apply to accounting units for disclosure, support and target
  - Single accounting unit for disclosure, support and target
  - Disclosure is only purpose of tracking

**D. Reliability and verification measures**

- **D.1 Independent verification of tracking results**
  - Mandatory for all participants
  - Selective verification by the regulator
  - Verification on voluntary basis only

- **D.2 Redemption of accounting units**
  - Mandatory for all uses
  - Mandatory for disclosure only
  - No requirements