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Assessment of the cost of a European tracking scheme

Work Package 5 report from the E-TRACK project

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A report prepared as part of the IEE project
„A European Tracking System for Electricity (E-TRACK)"

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The E-TRACK Project

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 work package is based on the results from earlier work in the project. 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.

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1 Introduction

1.1 Basics of the European Tracking Standard (E-TRACK standard)

The E-TRACK standard is specified in detail in the corresponding work package reports: work package 3 (Non-technical specifications for the European tracking system) and work package 4 (Technical specifications for the European Tracking System). This section summarises the main principles of the E-TRACK standard.

All tracking activities are organised in domains. A domain consists of a geographical area (e.g. a Member State) and one or several schemes, which make use of tracking results (e.g. disclosure scheme). All domains in the E-TRACK standard must be defined clearly and unambiguously. All domains provide facilities for explicit and, in case of disclosure, also for implicit tracking of the attributes of electricity generation episodes.

Explicit tracking is based on transferable evidence (certificates), which can be issued, transferred and redeemed. Explicit tracking can be done wherever possible, and implicit tracking, based on the residual mix, should only be used for electricity volumes, for which no explicit tracking information is available. In these cases, the use of the residual mix is binding.

The technical core of the E-TRACK standard is a registry for explicit tracking. A registry is a database which allows the ownership of attributes to be tracked via electronic certificates and which supports transfers of ownership both within a registry and to other registries under the tracking standard. The registry supports redemption of certificates, which means that the value of the certificate is realised and credited to the current owner. Consequently, the certificate cannot be transferred any more after its redemption. The registries are linked to a central hub, which enables the exchange of certificates and the management of joint information for all domains participating in the E-TRACK standard. Other existing tracking systems, such as quality labels for green power operated by private or public entities, should also apply the E-TRACK standard in order to avoid multiple counting of attributes. Each registry which handles certificates eligible for disclosure will supply input to a procedure for the calculation of a residual mix.

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

Various functions and operational structures (on the domain level, inter-domain level and European level) have been identified for implementing a system corresponding to the E-TRACK Standard. The Scheme Authority is responsible for scheme definition. It

controls eligibility for a scheme and determines compliance with that scheme. The Issuing Body is responsible for examining the evidence collected and controlling the issuing and redemption of certificates for schemes. The Registry Operator runs the registry and manages the data contained within it. This function might be performed by the Issuing Body itself or by a separate actor. The Accreditation Body carries out the verification of the plant registration details. The Data Collectors are responsible for obtaining the evidence of generation episodes. Usually, similar procedures are used for the settlement of the electricity market.

On the European level, a European governance organisation should be responsible for maintaining a robust and reliable infrastructure for electricity tracking by ensuring consistent standards in data collection, issuing, registry operation and redemption. This organisation would own the E-TRACK standard and would develop it further as appropriate.

1.2 Objectives of work package 5

The aim of work package 5 was to carry out a cost assessment for a European tracking system according the proposed E-TRACK standard (E-TRACK system), which was developed in work package 3 and work package 4.

The analysis took into account experiences of operators which already operate a tracking system or comparable systems. It is based on direct inputs, desktop research and discussions with various parties potentially involved in the implementation and operation of tracking systems.

The first step of the cost assessment was to identify the main cost drivers. The list of cost drivers was the basis for questionnaires/interview guidelines, which were sent to organisations that already operate and work directly with existing tracking systems and to potential users (electricity generators, electricity suppliers, electricity traders) of registries for electricity tracking. These are the main information sources for the cost assessment.

In addition, a recommendation on the distribution of cost was developed. Aiming at a balanced cost sharing model, the recommendation takes into account where the costs actually occur and who the beneficiaries of the tracking system are. Finally, a short qualitative summary of the benefits associated with the proposed E-TRACK standard is given, listing and describing the benefits.

2 Methodology of the cost assessment

2.1 System borders for the cost assessment

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

2.2 Gathering of cost information

The main source for cost information were organisations, which already have experience and have worked with existing tracking systems or comparable systems. This is essential in order to obtain robust results for the cost assessment based on practical examples and actual experiences. For example, the E-TRACK project partner E-Control has developed and operates a registry in order to administrate the Guarantees of Origin for RES-E in Austria. Similarly, the Dutch transmission system operator TenneT has long experience with the development and operation of tradable certificate systems for RES electricity and electricity from cogeneration. These and comparable systems are characterised by rather similar features as proposed by the E-TRACK standard. Therefore the cost information given by these organisations was the main data source for the cost assessment task.

2.2.1 Cost drivers and questionnaires for data collection

The first step of the cost assessment was to identify the main cost drivers of the tracking systems. The cost drivers of tracking systems can be classified according to different implementation phases of a tracking system (see
). One group comprehends the cost drivers for installing a tracking system (cost drivers for system development and implementation). This includes cost for setting up an organisational structure, for registry development (composing detailed system specifications, software development, development of interface to the hub, testing) and for training of market actors and users (composing information material for users, training courses).

The second group of cost drivers relates to the cost for system operation and for ongoing system adaptation. This group of cost drivers reflects the costs for governance of the overall system and the cost for keeping the tracking system running and up to date. Thus, system operation and system maintenance cost (hardware maintenance, software maintenance) are included as well as cost for user support and for ongoing system development in order to respond to user needs and changing policy framework conditions.

A third group of cost drivers summarises the cost for the system use, which includes cost for issuing aspects (certification and auditing of plants, collection of plant master

data, collection of generation data, verification of input data), for handling the information/certificate transfer and for usage and redemption aspects (conversion of data into format for final use, verification of output data, calculation of residual mix).

Table 1: List of cost drivers for tracking systems

Cost drivers for system development and implementation	
setting up organisational structures	
composing detailed system specifications	
software development/development of a registry	
collection of initial data input	
testing of registry	
organisation of data input	
development of interfaces between registries	
composing information material for users	
training of market actors	
Cost drivers for system operation and adaptation	
governance of the overall system	
operation and maintenance of the system (hardware maintenance, software maintenance)	
user support	
further development of the system due to user needs and policy development	
Cost drivers for system operation	
issuing aspects	
	certification and auditing of plants
	collection of plant master data
	collection of generation data
	verification of input data
transfer aspects	
	handling of information (certificate) transfer
usage and redemption aspects	
	conversion of data into format for final use (e.g. for disclosure)
	verification of output data
	calculation of residual mix

2.2.2 Surveys among stakeholders

Based on the list of cost drivers, a first questionnaire for gathering reliable and robust cost information was developed (see Annex 2) and sent out to organisations, which have experience and are actually working with existing tracking systems based on registries (see Table 2).

Table 2: Organisations contacted for the first questionnaire survey

Organisation
CertiQ (NL)
E-Control (AT)
ENERGINET (DK)
ETRANS (CH)
FINGRID (FI)
GREXEL (FI)
OFGEM (UK)
RED ELECTRICA (ES)
REN (PT)
STATNETT (NO)
SVENSKA KRAFTNÄT (SE)
VREG (BE)

Based on the first results and the discussions about the key elements of a European tracking standard, a second questionnaire was developed in order to improve and refine the cost information basis. This questionnaire was drafted as an interview guideline addressing organisations that are potential users of registries for electricity tracking according to the tracking standard (electricity generators, electricity suppliers, electricity traders). The interview guideline was sent to the project team members and was used by them to gather additional cost information from selected national stakeholders (see Annex 3).

The information gathered from the questionnaires in combination with expert judgements and inputs from stakeholders during the consultation process was used to assess the cost for the proposed tracking standard. Most of the benefits of the E-TRACK standard are already specified in work package 3 and work package 4. In this report, the benefits are summarised and listed in order to obtain at least a descriptive assessment of them.

3 Assessment of the cost of an E-TRACK system

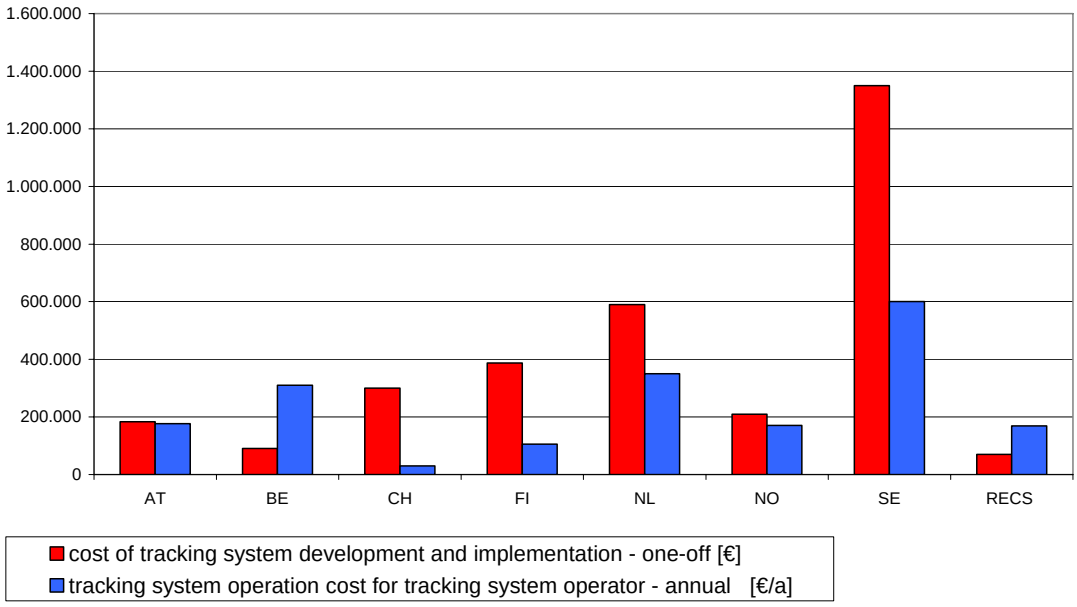
The aim of work package 5 of the E-TRACK project is to make a cost assessment for tracking systems which could be implemented based on the E-TRACK standard. This assessment is based on discussions with potential implementers, operators and users of tracking systems, which will apply the proposed tracking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

3.1 Cost of existing electricity tracking systems or comparable systems

Based on the information from the questionnaires, additional desktop research and discussions with various parties potentially involved in the implementation and operation of tracking systems, the cost of existing registries for electricity generation attributes have been analysed.

The results are summarised in Figure 1 and in Table 3, which provide both the one-off cost as well as annual operational cost of existing tracking systems in Austria, Belgium (Flanders), the Netherlands, Norway, Finland, Sweden and Switzerland are given; in addition the cost information for the Renewable Energy Certificate System (RECS) in one country is given.

Figure 1: Cost of existing tracking systems



Source: Investigations of AEA

Table 3: Cost of existing tracking systems

		AT	BE	CH	FI	NL	NO	SE	RECS
cost of tracking system development and implementation - one-off	[€]	183.000	90.000	300.000	387.000	590.000	209.000	1.350.000	70.000
tracking system operation cost for tracking system operator - annual	[€/a]	176.900	310.000	30.000	105.000	350.000	170.250	600.000	169.000

Source: Investigations of AEA

The cost of existing tracking systems/registries vary in a rather big range. The cost for tracking system development and implementation range from EUR 100.000 to EUR 200.000 at the low range, from EUR 300.000 to EUR 600.000 at the medium range and up to EUR 1.300.000 at the high range.

The situation is rather similar for the operational cost of tracking systems which are effective for the registry operator; at the low range they are between EUR 50.000 and EUR 200.000 per year, at the medium range between EUR 300.000 and EUR 400.000 per year, and at the high range up they amount up to EUR 600.000 per year.

Reasons for the big differences in cost can be found in the different levels of policy integration of the tracking systems and the different requirements resulting from it. Some tracking systems are on a voluntary basis, addressing a small market segment (e.g. green power supplied by renewable certificates), some are voluntary but provide a relevant service to the electricity market (e.g. information evidence for electricity disclosure) and some are fully integrated, which means that mandatory support instruments of high financial relevance (e.g. quota obligations, bonus payment for eligible power generation) are based on the tracking system. The degree of policy integration can be seen to be the most important cost driver of a tracking system.

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

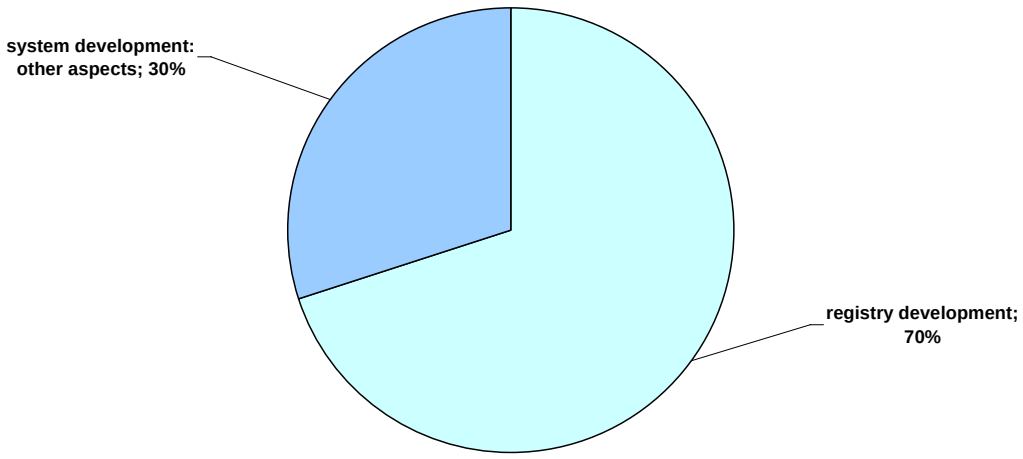
The cost for developing the registry represent the most relevant cost share within the cost group for tracking system development and implementation. These cost, which amount up to 70 % of the total cost for developing a tracking system, include composing detailed system specifications, software development, development of interface to the hub and testing. The remaining 30% are mainly cost for setting up the organisational structure and for training market actors and users (see Figure 2).

Figure 3 shows the cost structure for the operation of existing tracking systems. 45 % of the total operational cost are caused by governance of the overall system and by cost to keep the tracking system running and up to date. This includes system operation and system maintenance cost (hardware maintenance, software maintenance) as well as cost for user support and cost for ongoing system development. Cost related to issuing aspects (certification and auditing of plants, collection of plant master data and generation

data, verification of input data) represent around 25 %. At the same level are the cost for usage and redemption aspects (conversion of data into format for final use, verification of output data, calculation procedures and reporting.).

Tracking of attributes based on a registry has the big advantage to handle all attribute information electronically. The transfer of attributes from one actor's account to another can be accomplished directly within the registry, without any paperwork. Thus, cost for transferring attributes are relatively low and only amount to approximately 5% of the total operational cost.[1]

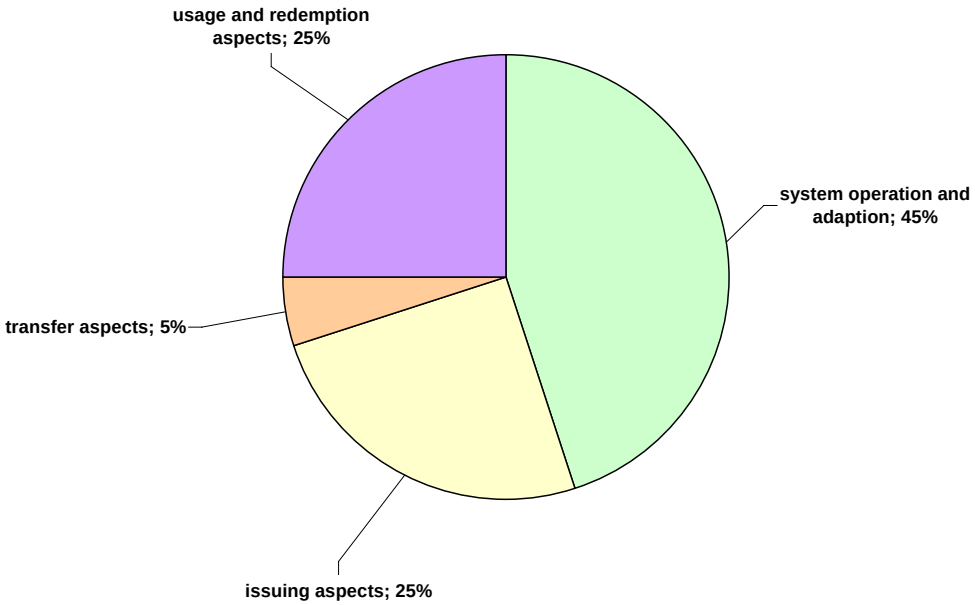
Figure 2: Structure of cost for system development and implementation of existing tracking systems



Source: Investigations of AEA

[1] Cost structure information is mainly based on experiences in Austria and in the Netherlands. For both countries very detailed cost information was available.

Figure 3: Structure of cost for system operation of existing tracking systems



Source: Investigations of AEA

The European Emission Trading Scheme (ETS), which was introduced across Europe to reduce emissions of greenhouse gases, is based on registries, too.[2] National emission trading registries are linked to a European hub (CITL-Community Independent Transaction Log) for checking and verifying the transactions of emission certificates between national registries. The cost for the development and implementation of a national ETS-registry is around EUR 400.000 for small countries and around EUR 500.000 for big countries. The operational cost are given with EUR 500.000 per year for small countries and EUR 670.000 per year for big countries.[3] The cost for the European ETS hub are about EUR 1.800.000 for its development and about EUR 700.000 per year for its operation. Although the ETS pursues a different purpose than the E-TRACK scheme (focussing on emission allowances for combustion plants of at least 20 MW thermal capacity), it can still be used as a reference point for the cost of certificate schemes.

3.2 Implementation structure and scenarios for cost assessment

The E-TRACK project defines a European standard for electricity tracking (E-TRACK standard), but does not specify every detail of its implementation. A core element of the tracking standard are registries on a domain level which are able to record and track ownership of attributes for electricity from all fuel sources. The individual domain reg-

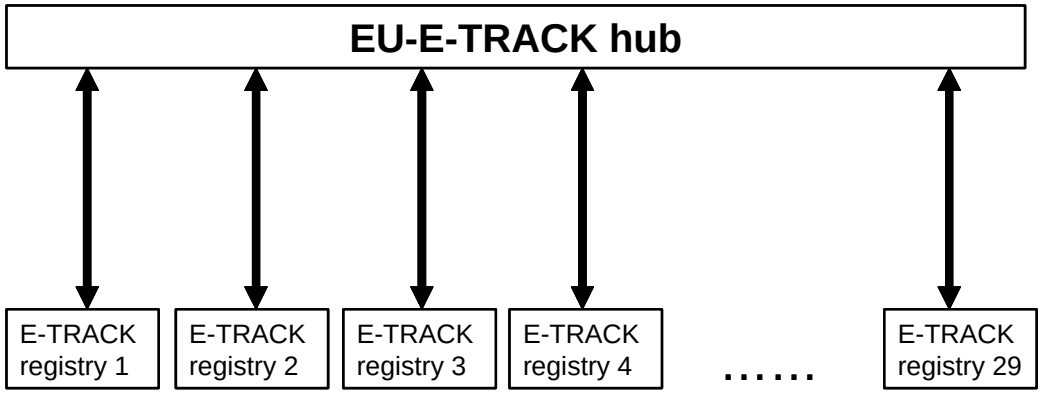
[2] http://ec.europa.eu/environment/ets/registrySearch.do

[3] Based on information of operators of national ETS registries, e.g. Umweltbundesamt in Austria.

istries have no interface among each other but each of them is linked to a common hub. The common hub has the function to transfer attribute information from one domain registry to another.

For the cost assessment it is assumed that all EU Member States plus Norway and Switzerland will each run one domain registry on the national level, and a common hub will be implemented for the exchange of certificates. This means that 29 registries and one European hub have to be developed, implemented and operated, as the structural backbone of a common E-TRACK standard in Europe (E-TRACK system). Thus, the structure of the E-TRACK system outlined in Figure 4 is the basis of all upcoming scenarios for cost assessment.

Figure 4: Implementation structure of the E-TRACK system



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

Lower scenario:
The lower scenario is seen as a basic implementation of the E-TRACK standard. In this scenario, existing organisations (e.g. regulators, TSO) are asked to implement and to operate the tracking systems in each domain. Additionally, there are already procedures in place which are coherent with procedures for electricity tracking: auditing procedures for RES-E and HE-CHP power plants, and automated issuing at least for these two types of plants. This scenario represents a very straight forward implementation of a E-TRACK system focussing on disclosure purposes.

Advanced scenario:
The advanced scenario represents an extension of the lower scenario. In the advanced scenario it is assumed that new organisations for the implementation and operation of the tracking system have to be set up in all domains. This leads to higher expenditures, e.g. for establishing communication procedures with electricity market actors. Similar to the lower scenario, existing procedures can partly be used for electricity tracking. In this scenario, the E-TRACK system is embedded in a more integrated policy framework. Besides just being the backbone for electricity disclosure, the E-TRACK system supports e.g. specific public support schemes for RES-E. This means higher functionality of the tracking system and consequently higher cost.

Upper scenario:
The upper scenario is an extension of the advanced scenario. It is assumed that the E-TRACK standard is fully integrated in the policy framework and is the authorised tool to administer national RES-E support schemes. So the system requirements for reliability, accuracy and security are very high in this scenario, which leads to significantly higher cost for system development and operation.

3.3 Assumptions and calculation procedure

As a first step, the cost of development and implementation of a tracking system in a single domain and its operational cost for the system operator are determined for each of the scenarios. As the scenarios are developed in accordance with existing tracking systems characterised by similar features, similar cost can be assumed. Based on the cost information of existing systems and on an analogy approach, the cost of a tracking system in one domain are summarised in Table 4 for the different scenarios.

Table 4: Cost for a tracking system in an average domain

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

In a further step, the cost of the system in a single domain are scaled up to the European level, assuming a similar implementation of the tracking system – according to the scenarios – in all 29 countries (EU27 plus Norway and Switzerland).

Different cost levels of countries and higher expenditures for big countries were taken into account when scaling up the cost to the level of 29 countries. Cost or investments for already existing systems are not deducted, because the cost assessment is aiming to display the maximal possible range of cost of a tracking system according the

E-TRACK standard. This procedure follows a conservative approach of assessing the cost of the E-TRACK system.

The cost of the common hub are assessed based on the cost information given by the experiences of the Association of Issuing Bodies (AIB)[4] of the establishment of the European hub for the ETS. Again the detailed implementation of the hub and its underlying procedures are influencing the cost significantly. The main function of the E-TRACK hub is to secure correct transactions of attributes between domain registries and to contribute to the calculation of a trans-national residual mix. The definite cost for the hub are deduced from AIB experiences for the lower scenario and from ETS hub for the upper one (see Table 5).

Table 5: Cost assumptions for a common hub

hub		lower scenario	advanced scenario	upper scenario
cost for hub development and implementation	[€]	**200.000**	**400.000**	**1.500.000**
hub operation cost for system operator	[€/a]	**150.000**	**300.000**	**600.000**

Cost for plant certification and auditing are considered to be a very relevant factor. Certification and auditing procedures are already established in many countries for most of the small plants - particularly for those covered by support schemes. These procedures should be used directly for the tracking system, or modified as required.

Around 10.000 larger plants[5] exist in Europe and it is assumed that this number of plants has to be audited every five years. This means that about 2000 plants have to be audited per year in all scenarios. The cost for plant auditing given by market actors vary from EUR 300 per plant (lower scenario) to EUR 2.500 per plant (upper scenario). The assumptions for cost calculations for plant certification and auditing are summarised in Table 6.

[4] http://www.aib-net.org

[5] Source: UCTE

Table 6: Cost assumptions for plant certification and auditing

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

On the European level there are some 3.000 electricity suppliers,[6] which are considered to be the potential users of a tracking system. However, it is rather unlikely that all users will actively work with the certificate system; some could cooperate with others or delegate this task to external parties and some will remain passive and just rely on the residual mix. So for the cost assessment it is assumed that only part of the users are actually actively using the tracking system (600 users in the lower scenario, 1.200 users in the advanced scenario, 1.800 users in the upper scenario). Moreover the operating expenses (working days per year) are judged differently by the market actors depending on the complexity of the systems and the number of transactions involved. In the lower scenario 12 working days per year respectively 36 working days per year in the upper scenario are assumed for the cost assessment. The labour cost are assumed to be EUR 600 per day for all of Europe (see Table 7).

Table 7: Cost assumptions for potential users of tracking

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

3.4 Results of the cost assessment

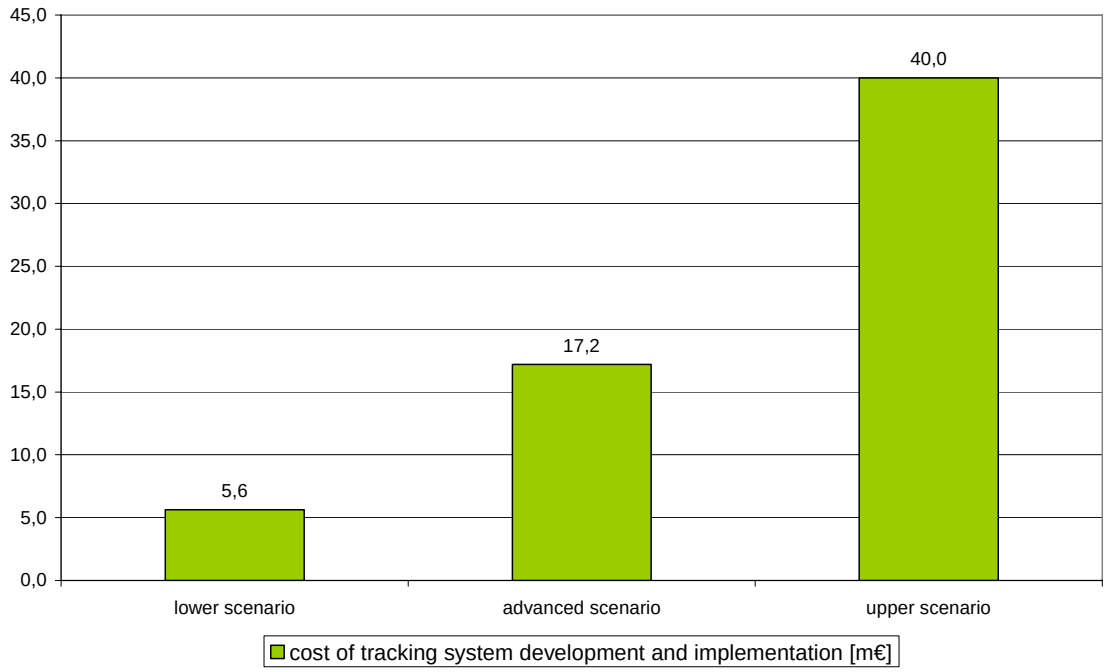
The cost assessment does not claim to determine the exact cost for a specific implementation of the E-TRACK standard in Europe, it rather aims at illustrating the cost range for an implementation of the E-TRACK standard. The lower scenario represents the lower bound of cost, whereas the upper scenario reflects the cost maximum. Particularly the upper scenario might represent an overestimation of the total cost, because it is quite unlikely that all countries will implement a fully integrated tracking system.

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

Moreover the assessment does not assume any learning effects and synergies between existing and new domains joining the standard. First of all it is safe to assume that the more tracking systems are developed and implemented, the cheaper the development of new ones will be. It is also possible that one registry software developed for a specific country may be used in other countries, too. Such developments can lower the implementation cost significantly. It is also possible that some countries share a common tracking registry, which will reduce cost as well.

The total cost of the development and implementation of the E-TRACK system in 29 domains and of a central hub are illustrated in Figure 5. For the lower scenario the cost result in EUR 5,6 million and for the upper scenario in EUR 40 million. These cost are one-off cost and are incurred mainly by the organisations that are responsible for the system introduction and operation.

Figure 5: Total one-off cost for the development and implementation of the E-TRACK system in 29 European countries



Source: Calculations of AEA

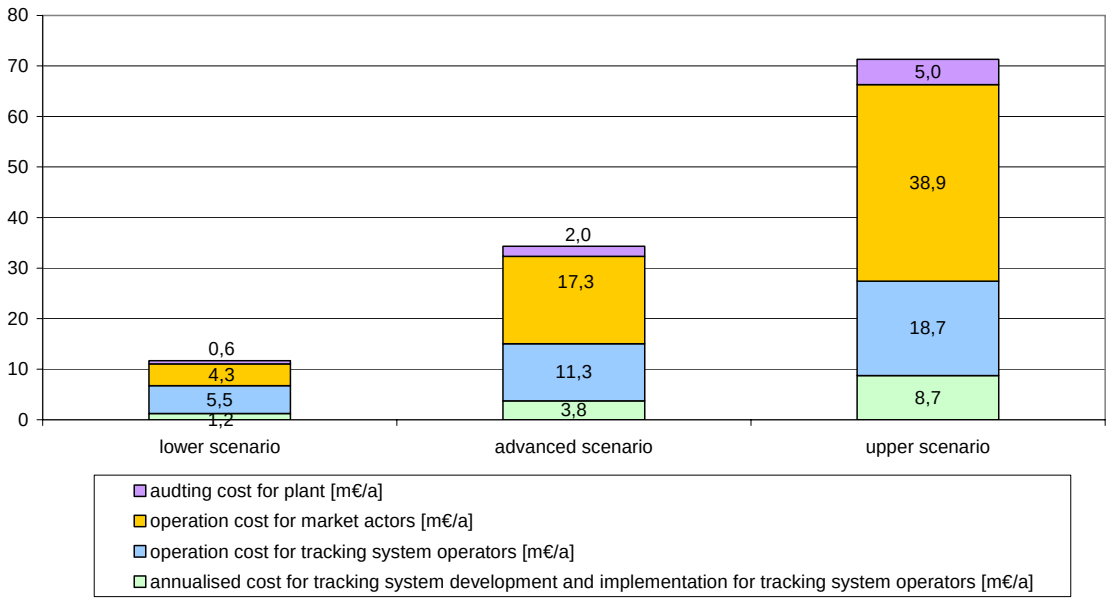
The total annual cost of the full European tracking system including the operational cost and annualised cost for system development and implementation[7] are illustrated in Figure 6. The cost add up to EUR 11,7 million per year in the lower scenario and to EUR 71 million per year in the upper scenario. The operational cost are mainly driven

[7] For this calculation, a discount rate of 3% and a depreciation period of 5 years has been used.

by the cost of external users of the system and the operational cost of the tracking system operator.

A significant share of the operational cost accounting for the external users depends on their expected involvement and amount of work when using the tracking system. External users of the tracking system also benefit from facilitation of market instruments (e.g. electricity disclosure) and additional marketing possibilities (e.g. differentiation of electricity products). Cost for auditing of power plants are not so relevant compared to the other cost categories.

Figure 6: Total annual cost for the E-TRACK system in 29 European countries



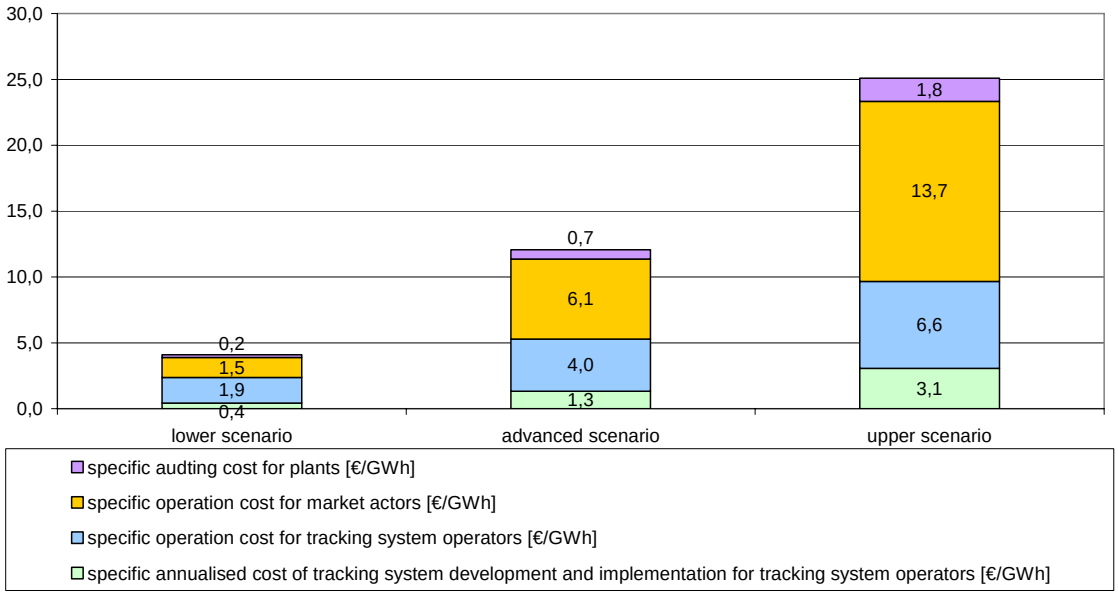
Source: Calculations of AEA

The specific cost for the E-TRACK system, calculated as the total system cost divided by the electricity consumption in Europe,[8] are illustrated in Figure 7. This calculation actually means an equal distribution of the cost for the E-TRACK system among all European consumers, based on their consumption. The cost for tracking can be related to the wholesale market price for base load electricity, which currently is around EUR 50 per MWh. In the lower scenario the specific cost for tracking amount to EUR 4,1 per GWh which corresponds to 0,0082 % of the current wholesale market price, whereas in the upper scenario the specific cost amount to EUR 25,1 per GWh which corresponds to 0,05 % of the wholesale market price. This means that if the cost

[8] Electricity consumption of EU25+Norway+Switzerland was 2.770 TWh (Source: Eurostat 2004).

for tracking are distributed equally across all customers, the impact of the implementation and operation of the E-TRACK system on the market prices for electricity is very low in all scenarios.

Figure 7: Specific total cost for the E-TRACK system in 29 European countries



Source: Calculations of AEA

In reality, it can be assumed that for the time being only part of the electricity generation will be tracked explicitly, whereas electricity from other sources will mostly be tracked implicitly. This will mostly be electricity from renewable energy sources.[9] In such a framework, an equal cost distribution of tracking cost on all consumers on a pro-rata basis does not seem to be generally realistic, because it could be assumed that the some cost elements for explicit tracking will be allocated in particular to those consumers which use explicit tracking information, and not to all consumers.

Thus some cost elements that are specific for explicit tracking (in particular cost for market actors and for audits) are related to the explicitly tracked amount of electricity. Cost aspects that keep the overall tracking system running can be related to the total electricity consumption.

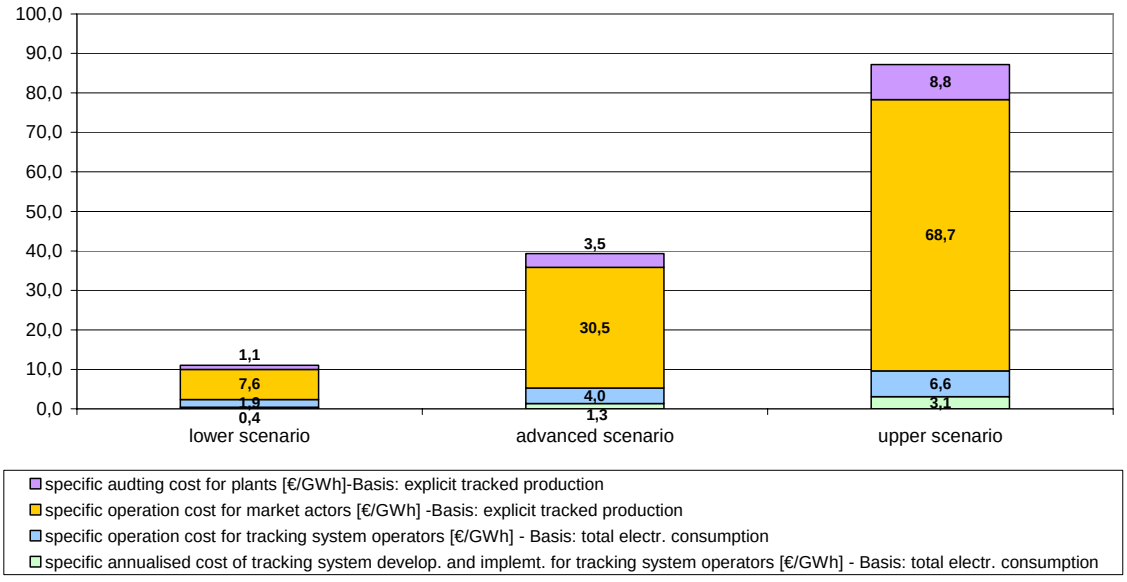
The result of a cost allocation following this approach is illustrated in Figure 8 and Figure 9. For consumers using explicitly tracked information, the tracking cost result in a range between EUR 11,1 per GWh (0,022 % of the wholesale market price) in the

[9] The electricity generation from renewable energy sources of EU27 plus Norway and Switzerland was about 566 TWh (Source: Eurostat 2004).

lower scenario and in EUR 87,2 per GWh (around 0,17% of the wholesale market price) in the upper scenario. Again in the lower scenario and in the advanced scenario the impact on the market prices for electricity is very low. Only in the upper scenario, which represents the maximum of expected cost for implementation of the E-TRACK standard, the cost reach a level of approx. two percent of the wholesale market price, indicating a noteworthy impact on the market price. This cost allocation is a conservative one because in particular the audit cost for the plants will not incur fully in the implementation phase of the E-TRACK system.

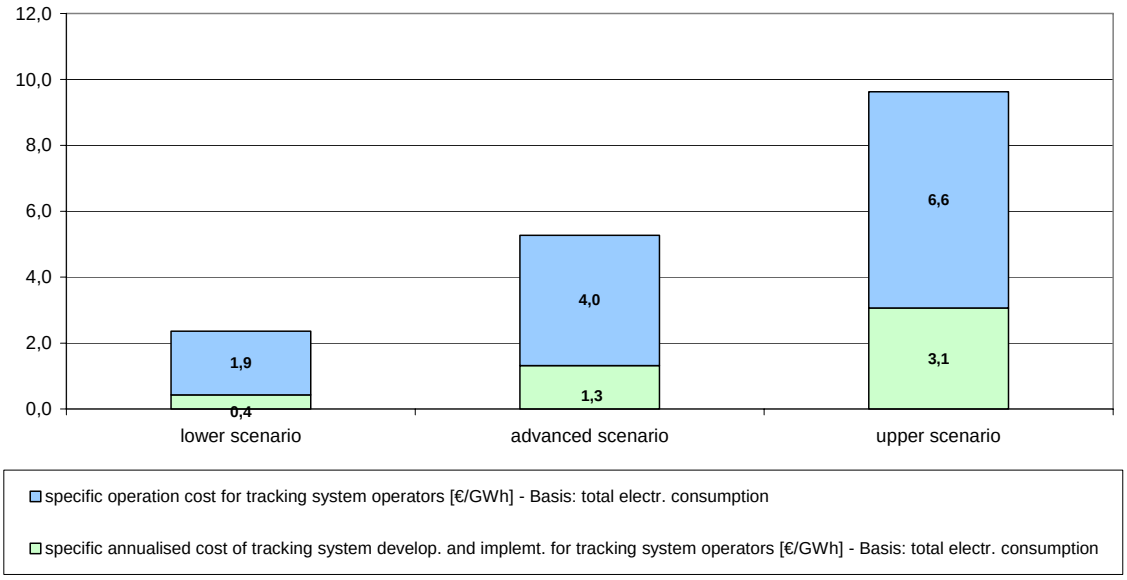
The tracking cost for consumers which rely on the residual mix for purposes of disclosure can be calculated as the general system cost - operational cost for system operators and the annualised cost for system development and implementation - divided by the total electricity consumption in Europe. The result of this calculation is shown in Figure 9.

Figure 8: Average cost of tracking within the E-TRACK standard for electricity using explicit tracking



Source: Calculations of AEA

Figure 9: Average cost of tracking within the E-TRACK standard for electricity supply which relies on the residual mix

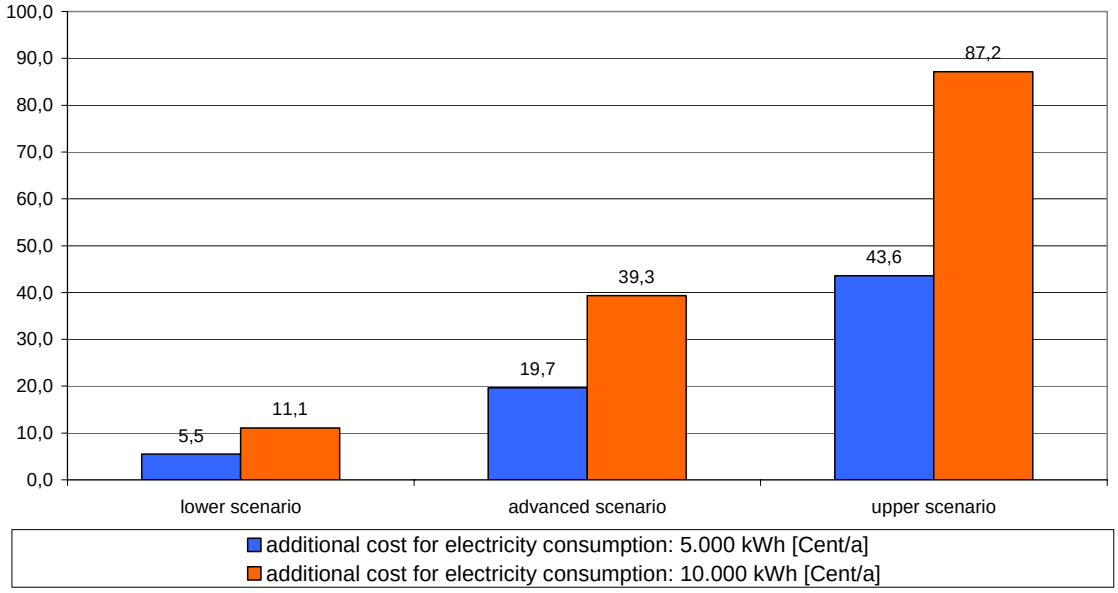


Source: Calculations of AEA

The cost for explicit tracking as illustrated in Figure 8 will finally be shifted to those consumers who benefit from explicitly tracked information. This would be consumers who are interested e.g. in a certain electricity product - probably a green one - and/or in a definite supplier portfolio proved by explicit tracking. Figure 10 displays the annual cost of explicit tracking for consumers with an explicit tracked electricity consumption of 5.000 kWh/a and 10.000 kWh/a. The cost of tracking amount to 5,5 Cent/a in the lower scenario and to 43,5 Cent/a in the upper scenario for an electricity consumption of 5.000 kWh. For an electricity consumption of 10.000 kWh/a, the additional cost are twice as high.

In conclusion, the impact of electricity tracking on the cost of electricity is very low for all consumers, even if they rely on explicit tracking for disclosure of their electricity.

Figure 10: Annual cost for tracking for consumers using explicit tracking (electricity consumption of 5.000 kWh and 10.000 kWh per year)



Source: Calculations of AEA

3.5 Recommendation for cost distribution

Basic considerations:

Recommendation on the distribution of cost among the parties involved take into account the results of the cost assessment and considers where the cost have actually occurred and who receives the benefits (see chapter 4). It aims at finding a balanced distribution of cost between the market actors and consumers.

A distribution of the total cost of the E-TRACK systems equally across all European electricity customers on a pro-rata basis could be justified, because the impact of the cost on the wholesale market price for electricity is very low (0,05 % on the wholesale market price in the upper scenario). And in principle all consumers can benefit from explicitly tracked information through increased market transparency.

In a first stage only a part of the electricity generation, mostly electricity from renewable energy sources, will be tracked explicitly and not all consumers will make use of explicit tracked information. So alternatively to an equal distribution of the total E-Track cost, specific costs elements (cost for the users of the tracking system and for auditing plants) could be allocated in particular to those consumers which use explicit tracking information. – The concerned market actors (electricity generators, electricity suppliers, electricity traders and electricity generators) should decide how to allocate the cost to prices.

The following general rules for cost distribution are recommended:

- Cost related to development and implementation of the tracking system under the E-TRACK standard and the operational cost of the registry operator should be distributed equally among all electricity consumers. This is justified because all consumers could benefit from an increased market transparency thanks to tracking. A tracking system according to the E-TRACK standard allows in general all consumers to take a more informed decision e.g. as to which electricity supplier and/or a specific electricity product they choose. The distribution of cost should be done on a pro-rata basis, based on the consumer's electricity consumption, e.g. through a minimal increase of the electricity tariffs.
- Users of a tracking system according to the E-TRACK standard (electricity generators, electricity suppliers, electricity traders) should cover the cost for working with the system and using it themselves, as they benefit directly from tracking in many ways (e.g. marketing benefits, fulfilling disclosure obligations). They should be free to decide on how to allocate their cost to prices. They can either distribute the cost equally among all or just to a specific subset of commercial transactions, in particular to the explicitly tracked one.
- Cost for auditing plants should be covered by the plant operator. Of course these cost will be added to the generation cost, especially to the explicitly tracked generation. Again, these cost will be passed on to electricity traders who are interested to obtain explicitly tracked information. And they should be free to decide on how to allocate these cost to prices.

4 Benefits of using the tracking standard

It was not possible to assess the benefits of the E-TRACK standard in monetary terms, because a tracking standard is considered the backbone and infrastructure for different uses of attribute information (e.g. electricity disclosure, special power products, target and quotas etc.). These uses provide mainly qualitative benefits to the electricity sector, and not quantitative ones. The benefits of tracking are directly linked to the uses and to how they are implemented. The main purpose of the tracking system is to enable and facilitate an optimised implementation and operation of the uses for the market, including the provision of reliable tracking results.

Therefore this chapter focuses on a qualitative description of the benefits related to high quality information on electricity generation attributes.

The most important benefit of a tracking system based on the E-TRACK standard is that it can provide robust, reliable and high quality information on electricity generation attributes to market actors and consumers. Within the E-TRACK standard, multiple counting of electricity generation attributes is effectively avoided since the E-TRACK standard is supervising the whole lifetime of attribute information in the form of certificates or residual mix information. All relevant procedures of explicit tracking – issuing, transfer, redemption – are handled and supported by the infrastructure of the E-TRACK system, consisting of domain registries which are linked to a central hub. The residual mix calculation takes into account all the attributes which have been allocated by explicit tracking, and therefore provides a reliable set of default data for electricity disclosure in case that there is no other attribute information available.

Electricity attribute information processed by the E-TRACK system provides increased market transparency when used for electricity disclosure and for designing green power or other specified products. Increased market transparency is the precondition for consumers to make an informed choice of electricity products and/or electricity suppliers.

As it is supposed that consumers prefer electricity generated by renewable electricity sources,[10] the E-TRACK standard contributes to an increased market demand and market penetration of renewable electricity sources.

Furthermore, explicitly tracked attribute information enables electricity traders to conduct electricity product and portfolio management in an easy and efficient manner. By doing that, electricity traders are able to meet the consumers' demand in a more focussed way. The E-TRACK standard can therefore assist suppliers in entering into new business areas in order to attract new consumer groups by tailor-made electricity offers. Thus, electricity trades can benefit from using explicitly tracked attribute information for marketing purposes.

[10] Consumer aspects of electricity disclosure have been investigated in the project "Consumer Choice and Carbon Consciousness for Electricity (4C Electricity)" (http://www.electricitylabels.com). Consumer-related issues regarding the E-TRACK standard will be an important part of a second phase of the E-TRACK project which will start in October 2007.

In Europe, a relevant tracking system for electricity attributes, the European Energy Certificate System (EECS),[11] already exists. EECS is the successor of the former RECS system, which was a voluntary certificate system for renewable energy attributes. EECS now also includes Guarantees of Origin for renewable electricity as well as electricity from high-efficient cogeneration, and generic disclosure certificates for any kind of electricity generation. Within EECS, more than 100 companies trade certificates between 15 countries in Europe. Between the launch of the system in 2001 and June 2007, certificates representing the attributes of more than 240 TWh of electricity have been issued. The E-TRACK standard is based on the experience with EECS and develops it further into a comprehensive tracking system, including residual mix calculations and recommendations on how the policies on the uses of tracking results should be harmonised. Therefore the E-TRACK standard is able to secure and to enforce the attribute market for electricity.

If the attribute market is standardised through the E-TRACK standard and if a clear infrastructure with defined interfaces is established across Europe, potential synergies with internal accountancy systems and trading systems used by traders can be realised. The E-TRACK standard is simplifying electricity attribute trades; routine procedures help traders to handle attribute trades more easily and traders can benefit form expanded market possibilities.

A key objective of the E-TRACK standard is to track generation attributes for purposes of electricity disclosure. However, the standard can also manage attributes indicating whether e.g. a renewable generation source has received public support. This enables synergies with existing support mechanisms and can help to avoid double subsidisation of electricity in case of cross-border transfers. Although based on certificates, the E-TRACK standard is compatible with any kind of support system (feed-in systems, quota obligations, tax incentives etc.). The tracking standard can also help supported technologies to enter the free electricity market in the transition phase when public support is faded out, or in case that operators of supported generation choose to move into the free market. In this case, the tracking system can help to market e.g. renewable or CHP electricity at a price reflecting the (physical) market price plus an additional income from selling the specific generation attributes of these technologies.

[11] See the websites of the Association of Issuing Bodies, which governs EECS (http://www.aib-net.org), and of RECS International, the organisation of market players using EECS (http://www.recs.org).

5 Summary and conclusions

The aim of work package 5 of the E-TRACK project was to develop a cost assessment for tracking systems which could be implemented based on the E-TRACK standard, and to compare the cost with the achieved benefits. This assessment has been developed based on discussions with potential implementers, operators and users of tracking systems. On this basis, all relevant cost drivers have been identified and the cost associated with the proposed tracking standard have been assessed for a European wide implementation.

The cost assessment shows that the total cost of implementing and operating tracking systems based on the E-TRACK standard are low, both in absolute terms and in relation to the volumes of tracked electricity. However, in the upper cost scenario, cost for tracking will reach a noticeable volume (approx. EUR 70 million per year). However, actual costs might be lower than in the scenarios (up to 20%), taking into account the already existing tracking systems, which could be developed towards the E-TRACK standard instead of starting the system design from scratch. An increasing number of E-TRACK domains also leads to valuable learning effects and cost reductions. The E-TRACK standard also avoids the current cost of the various tracking systems which are currently operated by different actors in the electricity sector.

A proposal for a distribution of the cost to consumers has been developed. It allocates the general cost for the setup and provision of the tracking system equally to all consumers, based on their electricity consumption. For specific cost elements for explicit tracking (cost for the users of the tracking system and for auditing plants) the concerned market actors are free to charge those customers which choose electricity products or suppliers which base their portfolio on explicit tracking. Even in the highest cost scenario, these customers would have to bear additional cost for tracking, which are equivalent to only 0,2 % of the wholesale price for baseload electricity.

The most important benefit of a tracking system according to the E-TRACK standard is the provision of robust, reliable and high quality information on electricity generation attributes to market actors and consumers. E-TRACK systems avoid multiple counting of electricity generation attributes in an effective and efficient manner, because the E-TRACK standard is supervising the whole lifetime of attribute information. All relevant procedures for explicit tracking – issuing, transfer, redemption – and the calculation of a residual mix for a certain region are handled and supported by the E-TRACK systems.

The E-TRACK standard can provide significant benefits to all market actors. Consumers are provided with profound purchase information based on attribute information. Electricity traders and suppliers benefit from business facilitation and marketing possibilities. Policy makers can use the E-TRACK system for monitoring corresponding policies and the compliance with targets for specific generation technologies. Compared to these benefits, the low cost for the development and operation of the E-TRACK systems are clearly justified, if not even negligible.

6 Bibliography

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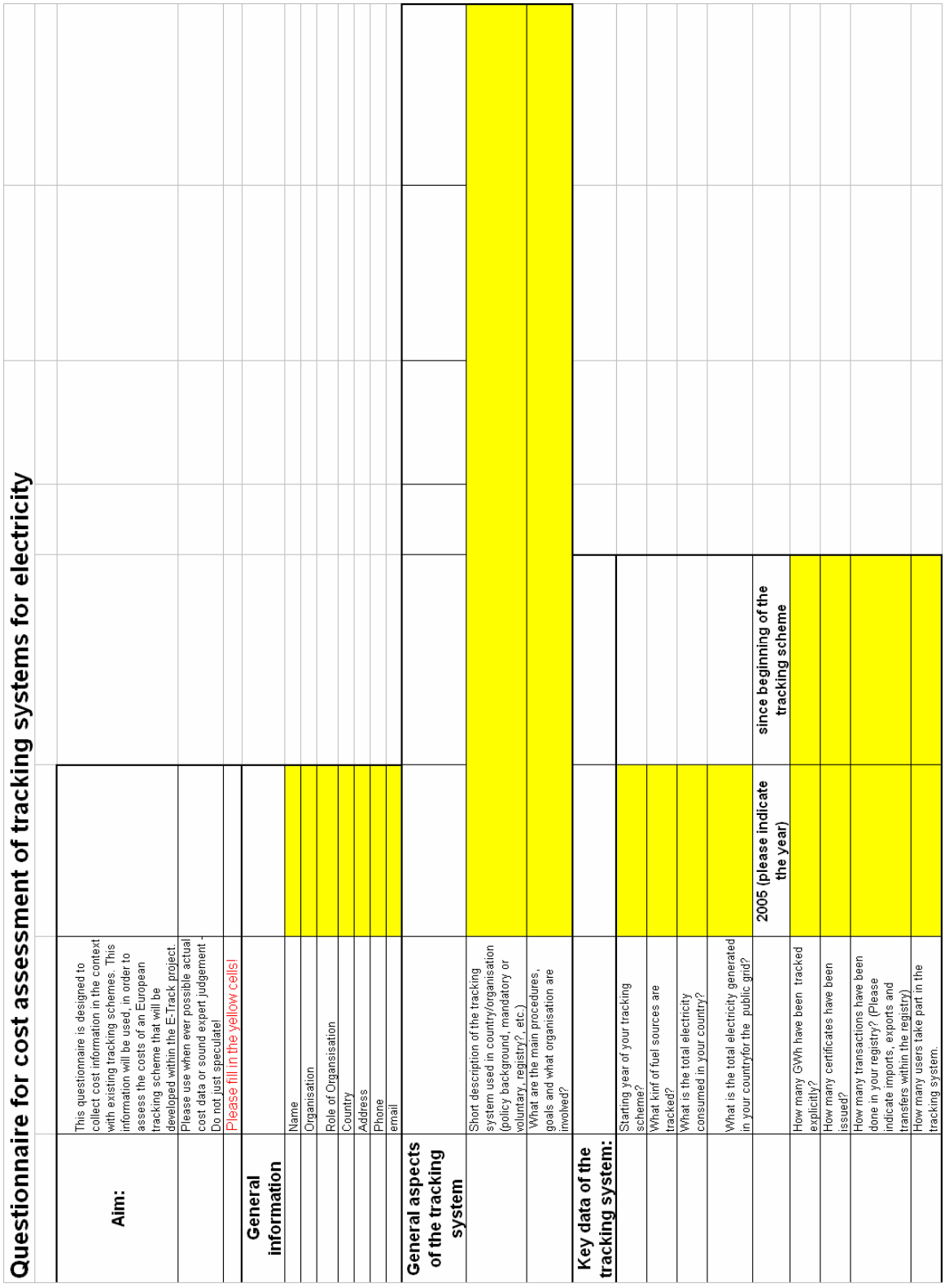
Annexes

Annex 1: List of abbreviations

CHP	Combined heat and power (= cogeneration)
HE-CHP	High-efficient cogeneration (based on criteria set out in the CHP Directive 2004/8/EC)
RES	Renewable Energy Sources (based on the definitions in the RES-E Directive 2001/77/EC)
RES-E	Electricity from Renewable Energy Sources
TSO	(Electricity) Transmission System Operator

Annex 2: Questionnaire for organisation which have experience with tracking systems based on registries



Questionnaire for cost assessment of tracking systems for electricity

Aim:	This questionnaire is designed to collect cost information in the context with existing tracking schemes. This information will be used, in order to assess the costs of an European tracking scheme that will be developed within the E-Track project.	
	Please use when ever possible actual cost data or sound expert judgement - Do not just speculate!	
	Please fill in the yellow cells!	
General information		
	Name	
	Organisation	
	Role of Organisation	
	Country	
	Address	
	Phone	
	email	
General aspects of the tracking system		
	Short description of the tracking system used in country/organisation (policy background, mandatory or voluntary, registry?, etc.)	
	What are the main procedures, goals and what organisation are involved?	
Key data of the tracking system:		
	Starting year of your tracking scheme?	
	What kinf of fuel sources are tracked?	
	What is the total electricity consumed in your country?	
	What is the total electricity generated in your countryfor the public grid?	
		2005 (please indicate the year)
	How many GWh have been tracked explicitly?	since beginning of the tracking scheme
	How many certificates have been issued?	
	How many transactions have been done in your registry? (Please indicate imports, exports and transfers within the registry)	
	How many users take part in the tracking system.	

Cost aspects of the tracking scheme

Phases	Question	Aspects, that could be included/considered	Comments (please give more details about this cost driver that is specific for your case)	Cost reference /basis (once, per anno, etc)	Costs [€]	Where do the costs arise and what is there share? (operator of the tracking scheme, electricity trader, generator, gridoperator, etc)	Who covers the costs? (operator of the tracking scheme, electricity trader, generator, gridoperator, etc)
system developement and implementation	What are the costs for...						
	...setting up the organisational structures?	-) studies for preparation -) introduction of the organsational structures -) using exisiting structures					
	...composing the detailed system specifications?	determination of the system specifications elaboration of specifications lists					
	... software development/developement of the registry?	-) programming the software					
	...collecting initial input data?	-) historic data, -) key data for user registration					
	...testing of the registry?	-) running the test procedures -) testing with users under real market conditions -) evaluation of tests					
	...handling and organising the data input?	-) automatically data input using the MSCONS-format -) decentral data input via web-interface -) manual data input					
	...developing data exchange interfaces between registries?	organising the data exchange: - manually - automatically via interfaces					
	...composing information material for users?	-) elaboration of user guides -) making handbooks for users , demos					
	...training the market actors?	-) running roadshows -) making training courses for users -) running demos					
		other cost driveres to be covered					

Cost aspects of the tracking scheme

Phases	Question	Aspects, that could be included/considered	Comments (please give more details about this cost driver that is specific for your case)	Cost reference /basis (once, per anno, etc)	Costs [€]	Where do the costs arise and what is there share? (operator of the tracking scheme, electricity trader, generator, gridoperator, etc)	Who covers the costs? (operator of the tracking scheme, electricity trader, generator, gridoperator, etc)
system operation and adaption	What are the costs for...						
	...governance of the overall system?	-) determination of the system rules					
	...for running and updating the system?	operation and maintenance of registry -) hardware maintenance -) software maintenance -) software licences -) (manual) data handling					
	...user support?	running a help desk -) hotline via telephone, email, etc.					
	...futher development of the system due to user needs and policy development?	-) adaption according specific user needs -) adaption due to policy change and change of framework conditions					
		other cost drivers to be covered					

Cost aspects of the tracking scheme

Phases	Question	Aspects, that could be included/considered	Comments (please give more details about this cost driver that is specific for your case)	Cost reference /basis (once, per anno, etc)	Costs [€]	Where do the costs arise and what is there share? (operator of the tracking scheme, electricity trader, generator, gridoperator, etc)	Who covers the costs? (operator of the tracking scheme, electricity trader, generator, gridoperator, etc)
system operation: issuing aspects	What are the costs for...						
	...certification and auditing of plants?	-) independent auditing procedures exist already and can be used -) separat audits are necessary					
	...collecting plant master data?	plant master data: -) used fuel source -) capacity -) emission data, etc update of plant master data					
	... collecting the actual generation data	-) automatically or manually -) update once a year or monthly or daily					
	...verification of input data?	-) pausibility checks -) spot checks -) automatically or manually					
		other cost drivers to be covered					
system operation: transfer aspects	What are the costs for...						
	...handling of information (certificate) transfers?	-) automatically done by the user -) manually procedures are necessary					
		other cost drivers to be covered					
system operation: usage and redemption aspects	What are the costs for...						
	...conversion of data into format for final use?	-) processing data for final use (disclosure, company reports, etc.)					
	...verification of output data?	-) independent verification -) pausibility checks -) spot checks -) automatically or manually					
	...calculation of the residual mix?	-) separate calculation of the residual mix -) using statistical data					
		other cost drivers to be covered					

Annex 3: Interview guideline for users of registries (electricity generators, suppliers and traders)

List of questions for collecting cost information for E-TRACK

The aim of the list is to get a proper developed cost information basis for an European tracking standard for electricity. The core element of the European tracking standard is the use of national registries, which are the instruments to handle all relevant procedures and processes referring to the tracking of electricity attributes (issuing, transfer, redemption). The questionnaire mainly addresses organisations that are "users of registries (electricity generators, electricity suppliers, electricity traders).

General questions:

What is the type and role of the company (generator, trader, supplier)? What are the key figures of the company ? (turnover, generation/trade/supply volume)

[Give basic information about each company and its main key figures]

What are the relevant cost aspects for your organisation when doing electricity tracking by using a registry? What factors drive/influence the cost aspects and how? (generation in GWh?, trade in GWh, number of transactions? number of contracts? Number of plants? participants in the registry? etc.)

[List the aspects according cost relevance, Indicate the cost drivers and quantify their influence]

What are the expected additional expenses for your organisation when doing electricity tracking by using a registry?

[Give numbers for person days/anno and costs/anno. Comment on the background of these numbers and indicate which aspects are covered by the costs.].

What are the benefits for doing electricity tracking by using a registry?

[List the items]

How many plants have to be registered in your country? What are the costs for auditing a plant in the registry?

[Indicate number of plants, auditing procedures, costs for auditing according plant type]

Specific questions:

What are the **costs for implementing** electricity tracking via registry in your organisation? *[Indicate overall costs for implementation phase]*

How many people will be trained in your company for working with the registry? And what are the costs for doing this?

[Indicate number of persons and the cost for training]

What are the costs for testing the registry?

[Indicate costs for testing]

Other costs during the system implementation?

[Indicate other cost aspects, which might be relevant and quantify them]

What are the **costs for doing electricity tracking via a registry** in your organisation? *[Indicate overall costs for running the system, annual costs]*

How many people will/do use the registry in your organisation? – What are the annual cost for that?

[Indicate number of persons and annual costs]

What are the costs for data input?

[Indicate data input and costs; e.g. cost per plant, costs per data set?]

How many transactions of attributes take place/do you expect and how will they develop in future? What are the cost for doing a transaction of attributes? Does the number of transactions influence the specific costs? What is the correlation?

[Indicate number of transactions per year and costs per transaction, quantify correlation]

What are the costs for doing data verification?

[Indicate verification procedures and costs]

Other relevant costs for doing electricity tracking via a registry?

Annex 4: Background data for the cost calculation

	Comparative price levels	Electricity-Generation [GWh]	Electricity-Consumption [GWh]	RES-E Production [GWh]
Belgium(BE)	106	84.618,00	79.677,13	1.676,00
Czech Republic (CZ)	58	83.223,00	52.381,52	1.880,00
Denmark (DK)	136	46.196,00	32.389,55	8.745,00
Germany (DE)	111	599.470,00	509.266,07	47.248,00
Estonia (EE)	57	10.153,00	5.570,77	40,00
Greece (EL)	85	58.478,00	48.590,14	5.787,00
Spain (ES)	93	262.860,00	219.993,08	58.817,00
France (FR)	109	566.900,00	408.433,97	65.098,00
Ireland (IE)	122	25.235,00	23.027,40	1.138,00
Italy (IT)	103	293.865,00	290.959,34	44.045,00
Cyprus (CY)	92	4.044,00	3.640,19	0,00
Latvia (LV)	48	3.975,00	5.175,35	2.338,00
Lithuania (LT)	48	19.488,00	7.140,82	332,00
Luxembourg (LU)	115	3.611,00	6.012,71	169,00
Hungary (HU)	62	34.141,00	31.401,00	365,00
Malta (MT)	68	2.236,00	1.814,28	0,00
Netherlands (NL)	109	96.775,00	100.355,27	5.431,00
Austria (AT)	108	63.170,00	60.673,71	38.466,00
Poland (PL)	58	151.631,00	98.343,28	2.250,00
Portugal (PT)	85	46.852,00	43.158,93	18.089,00
Slovenia (SI)	75	14.019,00	12.525,51	3.277,00
Slovak Republic (SK)	56	31.176,00	22.957,62	3.480,00
Finland (FI)	116	84.227,00	80.840,13	19.384,00
Sweden (SE)	118	135.571,00	129.767,54	59.414,00
United Kingdom (UK)	111	398.620,00	337.444,45	11.234,00
Norway (NO)	145	107.268,00	102.962,00	106.861,00
Switzerland (CH)	132	66.988,00	55.122,00	38.492,00
Bulgaria	29	43.511,00	26.942,00	4.890,00
Romania	29	55.246,00	45.237,00	16.627,00
	Source: OECD 2005, Eurostat 2004, Enerdata			