SIXTH FRAMEWORK PROGRAMME

Project no: **502687**

NEEDS

New Energy Externalities Developments for Sustainability

INTEGRATED PROJECT

Priority 6.1: Sustainable Energy Systems and, more specifically,

Sub-priority 6.1.3.2.5: Socio-economic tools and concepts for energy strategy.

Deliverable n° D12.3 – RS 2b

"Implementation, evaluation and reporting on the survey on criteria and indicators for assessment of future electricity supply options"

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Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1 Introduction

1.1 Scope and structure of NEEDS

The overarching goal of the EU-Project NEEDS (New Energy Externalities Development for Sustainability) is to evaluate the full costs and benefits of energy policies and of future energy systems, both at the level of individual countries and for the enlarged EU as a whole. From an organizational point of view, NEEDS is divided into eight so-called research streams and one integration stream. Although, each of these is devoted to a specific area of research, they can be assigned to three major groups, namely (1) enhancements in energy externalities, (2) development of long-term strategies, and (3) input to policy making and dissemination.

The primary objective of Research Stream 2b (RS2b) "Energy Technology Roadmap & Stakeholder Perspectives" is two-fold: (1) Evaluation of long term strategies and energy policies, based on the internalisation of external costs; and (2) Development and implementation of an extended framework for decision support beyond the assessment of external costs by examining the robustness of results under various stakeholders perspectives.

To address the two main objectives stated above, two different but complementary methodologies are applied to evaluate the sustainability of electricity production technologies and alternative supply scenarios. The first approach is based on total costs calculations (direct + external), whereas the second is based on a mapping of options based on the three principal pillars of sustainability (i.e., environmental, economic and social indicators) combined with stakeholder preferences. Stakeholders will be consulted to provide inputs relevant for both approaches.

Within Work Package 12 (WP12) of RS2b the survey questionnaire on sustainability criteria and indicators (in the following referred to as "Survey II") collects and analyses feedback from a large variety of stakeholders to obtain a consolidated and harmonized set of criteria and indicators to be used for the sustainability assessment of electricity production technologies.

1.2 Survey II overview

With regard to policy formulation, the NEEDS project also examines the robustness of results under different stakeholder perspectives. In the context of Survey II this comprises stakeholder feedback on the proposed set of criteria and indicators, and to elicit stakeholder preferences on the relative importance of these indicators. The current set is intended to cover the most important indicators, but not absolutely all conceivable indicators. This set will be used for multi-criteria decision analysis, and must be somewhat limited to keep the scale of the problem within reasonable bounds.

For this purpose a questionnaire has been developed, discussed, and implemented with partners. The questionnaire has been organised in five sections. Section 1 collects basic information to classify respondents according to the stakeholder categories and sub-categories defined within RS2b of the NEEDS project. Sections 2 and 3 ask for feedback on individual indicators as well as for feedback on the indicator set as a whole. The remaining sections (4 and 5) address socio-demographic and personal questions, and individual feedback on the difficulty and comprehensibility to fill in the survey.

The results of Survey II provide invaluable insight on the acceptability of the proposed set of criteria and indicators by stakeholders. Additionally, it could serve as a basis for potential modifications; of primary interest is whether the list of representative indicators could be somewhat reduced thus simplifying handling and communication. Furthermore, the results of the survey could lead to the conclusion that a significant number of stakeholders disagree with specific indicators or consider that certain important aspects are not covered in a suitable manner. In such a case more radical changes need to be considered in the future. The consolidated version of criteria and indicators will then be used in a follow-up survey (Survey III) of stakeholder preferences, i.e. asking for a relative weighting of the indicators relative to each other, providing direct feedback on technology rankings.

2 Organization of the questionnaire

2.1 Structure and description of questionnaire

The questionnaire of Survey II has been designed to explicitly assess stakeholders' acceptance of the proposed set of sustainability criteria and indicators to be used for the assessment of electricity production technologies. The questionnaire consists of a total of 60 question assigned to five sections:

1. Stakeholder profile (5 questions + 1 question for language selection)
2. Feedback on individual indicators (40 questions)
3. General feedback on the indicator set (5 questions)
4. Socio-demographic and personal questions (4)
5. Feedback on the questionnaire (5)

Stakeholder profile: The first part of the questionnaire collects information about stakeholder group affiliation. This is important for the analysis of results because various categories of stakeholder may differ in their preferences and opinions.

Feedback on individual indicators: Questions concerning individual indicators were first grouped by the three dimensions of sustainability (i.e. economic, environmental and social) and subsequently into topical areas, based on first-level criteria within each dimension. For each indicator the lower criterion hierarchy (i.e. second- and/or third-level) are also indicated, completed by a brief description. This approach provides a stringent template that allows the respondents to navigate more easily through the different hierarchical levels of the indicator set.

Three different questions are asked for each indicator:

- Relevance: Is the indicator relevant for the sustainability assessment of energy technologies?
  Answer categories: Very high / High / Medium / Low / Very Low.
- Necessity: Should the indicator be included in the final set of indicators or not? Not all strictly relevant indicators may be included for practical reasons - i.e. the relative balance between the number of economic, environmental and social indicators, and the total size of the multi-criteria analysis problem.
  Answer categories: Include / Do not include.
- Dimension assignment: Do you believe that the indicator should be moved to another dimension of sustainability?
  Answer categories: two other sustainability dimensions.

General feedback on indicator set: The third part of the questionnaire addresses general aspects of the indicator set:

- Do you agree with the chosen approach and the number of indicators?
- Which indicators do you consider most and least important, respectively?
- Are any indicators missing in your opinion?

Socio-demographic and personal questions: In this part of the questionnaire information is collected on the age and gender of participants, their highest level of education and country of residence.

Feedback on the questionnaire: At the end of the survey participants are asked for their personal feedback. This includes a rating of the difficulty of understanding and answering the questionnaire, and the possibility to add free comments. Additionally, people can voluntarily provide their e-mail address if they are interested to receive the final report of Survey II.

2.2 Stakeholder database

A comprehensive stakeholder database provides an essential prerequisite to perform a balanced and convincing survey. As a starting point the database already established for Survey I on the "Acceptance of the Externality Concept" has been used. However, collections of potential participants have been significantly increased for the four countries France, Germany, Italy and Switzerland, which are the main focus of Survey II. Additionally, numerous stakeholders from a variety of other countries were considered, including persons affiliated to the NEEDS project.

Table 1 provides an overview of the number of individual stakeholders that were selected in the four focus countries (i.e., France, Germany, Italy and Switzerland) and in 45 other countries encompassing EU and non-EU member states.

Table 1 Number of individual stakeholders in the various countries, to which Survey II was distributed.

Country	# of individual stakeholders
France	105
Germany	659
Italy	435
Switzerland	1120
Other countries	529
TOTAL	**2848**

In order to obtain a better understanding of the acceptance and potential criticisms of the proposed indicator set by European politicians a second run of Survey II was conducted. For this purpose, Globe Europe (Global Legislators Organisation for a Balanced Environment) was approached to ensure a comprehensive coverage of politicians across party- and country lines. The Globe Europe network includes about 1500 parliamentarians from EU 27 member states and from Norway, Iceland, Turkey, FYROM, Moldova and Croatia, striving to enhance sustainable development and support the protection of environment and biodiversity. In practical terms Globe Europe members were informed and asked for their participation in Survey II through the weekly newsletter of the organisation. The dedicated time window of Survey II for Globe Europe members was from 11 February to 6 April 2008. In total, 37 members of Globe Europe visited the website of Survey II, and only three filled in the entire questionnaire. The reasons for this very low response rate may be manifold, including the large number of requests to which politicians are expected to provide their opinion. As a consequence, no separate evaluation of Survey II results for European politicians was undertaken.

Finally, the stakeholder database contains representatives from different stakeholder groups, which may differ in terms of views towards the assessement of electricity generation technologies, based on a set of criteria and associated indicators. Therefore, the definition of major stakeholder categories provides an important initial step allowing a targeted analysis of survey results with regard to assignment of individuals to specific stakeholder groups. Within the NEEDS project a further refinement has been achieved by subdividing each main stakeholder category into several sub-categories. Table 2 gives an overview of this classification scheme.

Table 2 Different stakeholder categories and sub-categories as defined within RS2b.

Stakeholder Category **Stakeholder Subcategory**
Energy Supplier
Centralized or Decentralized
Manufacturer
Technology Agency
Transmission and Distribution
Sectoral Association
Energy Consumer
Technology Supplier
Energy Consuming Industry
Agriculture
Transport Sector
Services
Households
Technology Agency
Sectoral Association
Non-Governmental Organization (NGO)
International
European
National
Government Energy & Environmental Agencies
European
National
Regional/Local
Regulator / Government Authorities
European
National
Regional / Local
Association
European
National
Regional / Local
Politician
Left / Green
Center / Liberal
Right / Conservative
Researcher / Academia
Energy: Fossil
Energy: Renewables
Energy: Nuclear
Energy: Demand
Energy: Systems Analysis
Energy: Other
Non-Energy
Consultant
Small or Medium
Large (>30 employees)
Other

3 Development and implementation of Survey II

The work flow of Survey II can be structured in the following phases:

- Development of a first draft questionnaire based on the list of criteria and associated indicators that were established within WP3 of RS2b and was subject of extensive review by other research streams. Team members of RS2b also provided their comments and critiques on the initial draft questionnaire. As a result, numerous improvements were implemented.
- Based on this feedback a second version of the questionnaire was developed, which was subject to another internal discussion at the stream level.
- Finalization of questionnaire in English, and translation into French, German and Italian, and subsequent testing of questionnaire and software at stream level.
- Survey II was started on 23 November 2007 by sending out an announcement e-mail, followed by an invitation e-mail on 27 November 2007, which provided stakeholders with individual access information in the form of a personalized link, i.e. the internet address and a transaction authentication number (TAN).
- After closing of Survey II on 20 January 2008, data from participants were analyzed and summarized. Preliminary results were shown at the 5th RS2b meeting hosted by the International Institute for Applied Systems Analysis (IIASA) in Laxenburg (Austria) in March 2008. The final results are presented and discussed in chapters 4 and 5 of this report.

The different components of Survey II, such as announcement, invitation and reminder e-mails, and the complete questionnaire are included in the Appendix.

4 Survey II results

Invitations to participate in Survey II were sent to a total of 2848 persons (see Table 1). During the running time (27.11.2007 – 20.01.2008) 660 persons were visiting the survey website, of which 275 filled in the questionnaire completely, representing a response rate of 9.7%. Country-specific response rates are reported in Figure 1. The prevailing majority of the 385 partially filled in questionnaires contained very little information. Only 24 were mostly filled in up to question 23, and only two for most of the questionnaire. Therefore, only the data of the completed questionnaires were used for the subsequent analysis.

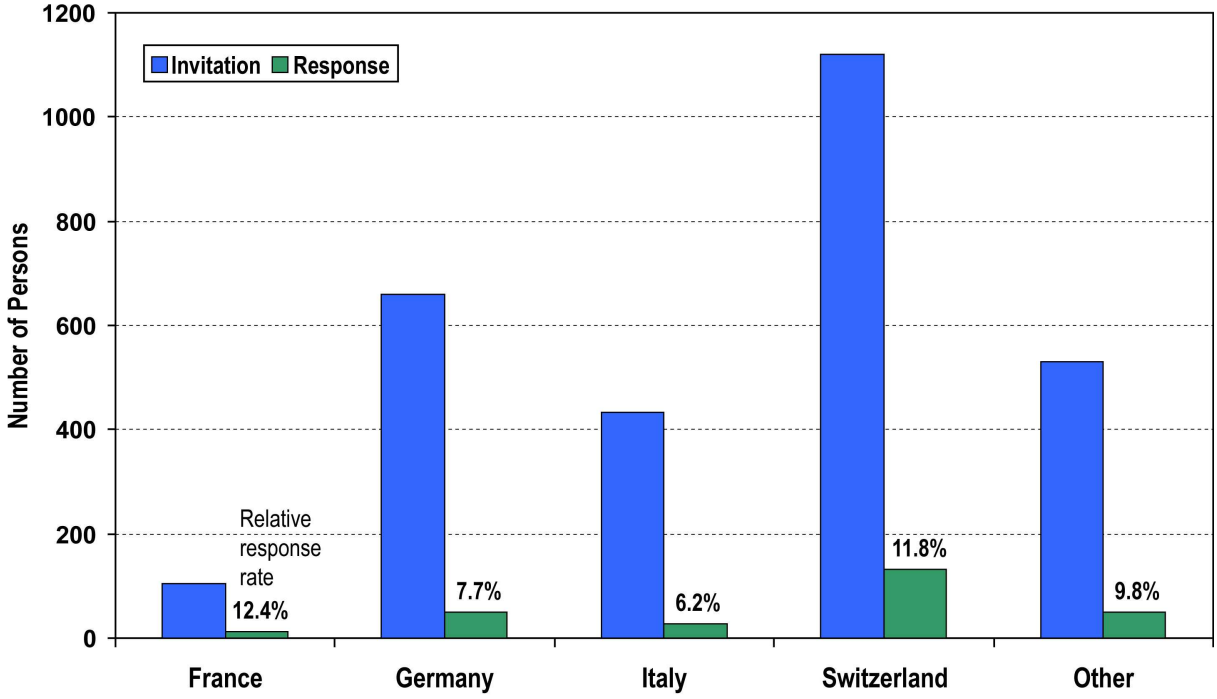


Figure 1 Country-specific response rates.

Participants predominantly answered the questionnaire in German and English, whereas the French and Italian versions were only used by roughly ten percent each (Figure 2).

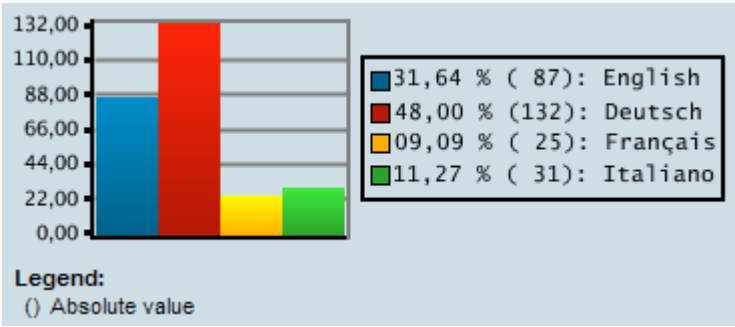


Figure 2 Languages in which participants answered the questionnaire.

4.1 Stakeholder profile

The first part of the questionnaire asked for the familiarity of the participants with the concept of sustainable develelopment, their familiarity with sustainability criteria in general and for the assessment of energy technologies in particular, and their self-assignment to one of the pre-defined stakeholder categories and sub-categories as used in NEEDS.

Almost two thirds of the participants rated themselves as highly familiar with the concept of sustainable development and another 30% as medium (Figure 3). Concerning the familiarity with sustainability criteria, more than 90% consider themselves of having a high or medium knowledge in general (Figure 4), and about 85% also for the assessment of energy technologies (Figure 5).

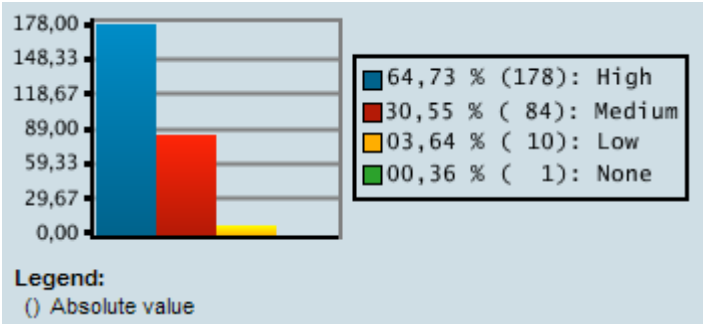


Figure 3 Familiarity with the concept of sustainable development.

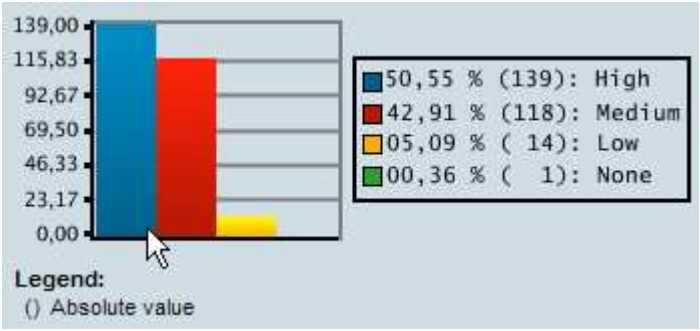


Figure 4 General familiarity with sustainability criteria.

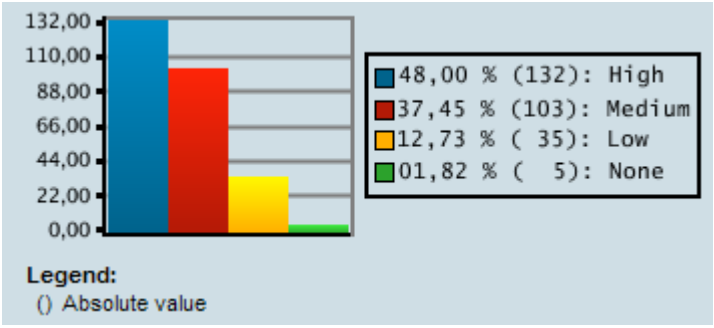


Figure 5 Specific familiarity with sustainability criteria for the assessment of energy technologies.

The participants were rather unevenly distributed among main stakeholder categories. The category Researcher/Academia strongly dominated (61.45%), and only three other categories reached contributions between five and ten percent, namely Energy Supplier, Government Energy & Environmental Agency, and Consultant (Figure 6).

Within the category Researcher/Academia the following sub-categories had the strongest representation: Energy Systems Analysis (19.27%), Renewables (9.45%), Nuclear (11.64%), Energy Other (6.18%) and Non-Energy (11.27%).

For Switzerland (132 participants) and Germany (51) country-specific results are shown in Figures 7 and 8, whereas for Italy (27) and France (13) too little data were available for a more detailed analysis.

In Switzerland 11.8% participated in the survey, of which 81 or almost two thirds belonged to the main stakeholder category Researcher/Academia. Within this stakeholder group, the sub-categories Nuclear (29), Energy Systems Analysis (18) and Renewables (13) had the highest contributions, whereas Fossil (3), Demand (2) and Energy Other (3) were marginal. Responses from scientists outside the energy domain amounted to 13. Finally, individual response rates of the categories Energy Supplier (25.4%), Regulator/Government Authorities (23.1%), Researcher/Academia (14.1%), and Consultant (14.0%) were significantly higher than for the other stakeholder groups that ranged from 0.5% to 7.3%.

In Germany 7.7% responded to the questionnaire, of which 32 were attributable to the category Researcher/Academia. The dominant sub-categories in this group were Energy Systems Analysis (8 participants), Renewables (5), Demand (5), and Non-Energy (9). The response rates for individual stakeholder categories were highest for Researcher/Academia (13.1%), Energy Consumer (9.5), NGO (7.1%), and Government Energy & Environmental Agency (7.0%).

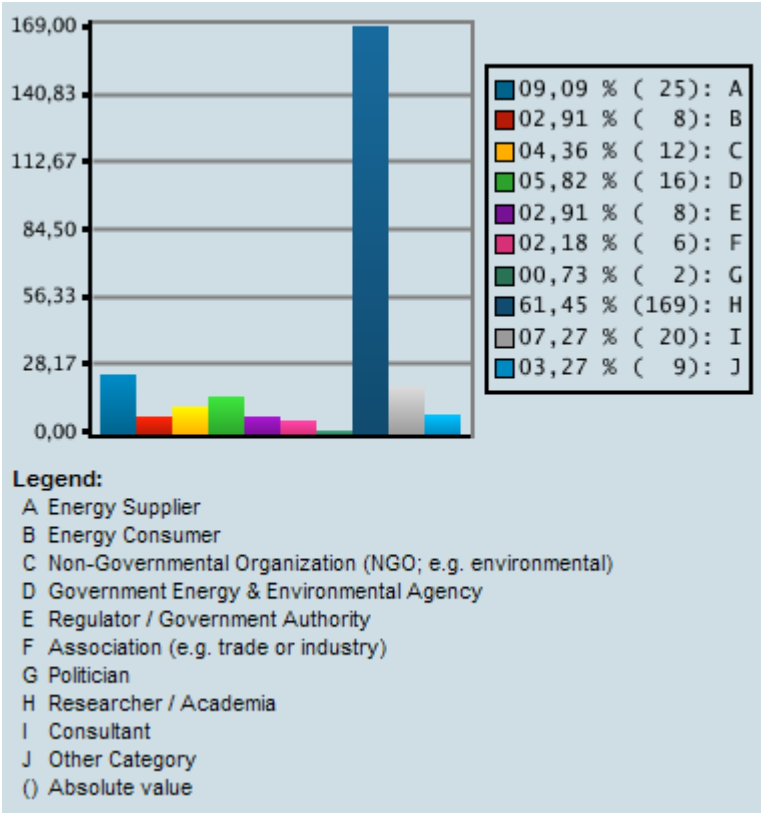


Figure 6 Breakdown of participant to main stakeholder categories.

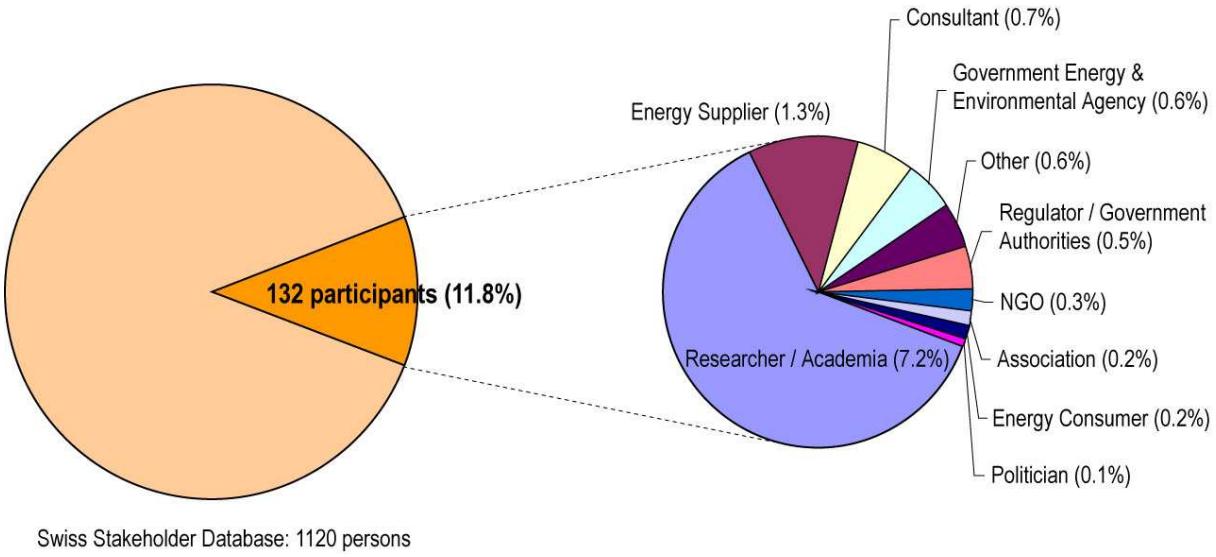


Figure 7 **Percent contributions of participants in the different main stakeholder categories in relation to the total number of persons in the Swiss stakeholder database.**

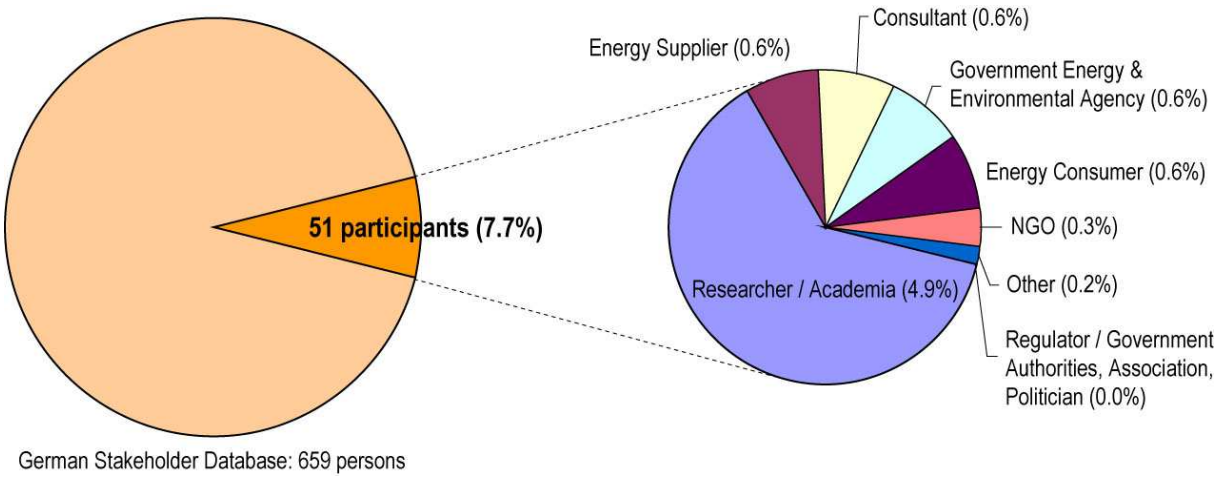


Figure 8 **Percent contributions of participants in the different main stakeholder categories in relation to the total number of persons in the German stakeholder database.**

4.2 Feedback on individual indicators

Overall, individual indicators showed a high acceptance by the participating stakeholders. Therefore the discussion is restricted to the few indicators that were most controversial. Table 3 lists those indicators that fulfilled at least one of the following criteria:

- *Relevance*: categories “low” and “very low” sum up to about roughly or more than 30%
- *Necessity*: category “Do not include” contributes about roughly or more than 30%
- *Move to other sustainability dimension*: the two other dimensions sum up to about roughly or more than 30%

Table 3 Individual indicators that had the lowest acceptance.

Indicator	30% criteria
Economic dimension	
Financial risks / Risk due to changes in boundary conditions	Do not include: 35.27%
Social dimension	
Perceived risks / Perceived risk characteristics for normal operation	Do not include: 30.55%
Socially compatible development / Work quality	Do not include: 42.18%

When the threshold for the above-defined acceptance criteria is lowered from 30% to 25%, several other indicators need to be looked at:

Environmental dimension (1): Mineral resources (ores): Do not include (29.45%)

Economic dimension (4): Employment: Do not include (25.82%); Financial risks / Capital investment exposure: Do not include (27.64%); Operation / "Merit order" for dispatch purposes: Do not include (28.73%); Operation / Flexibility of dispatch: Do not include (27.27%).

Social dimension (6): Political threats to continuity of energy service / Waste management: Do not include (29.45%); Flexibility and adaptation: Do not include (26.91%); Willingness to act (mobilization potential): Do not include (28.36%); Perceived risks / Perceived risk characteristics for accidents: Do not include (29.45%); Terrorist threat / Effect of a successful attack: Do not include (26.18%); Socially compatible development / Equitable life conditions: Do not include (28%).

In summary it should be noted that none of the indicators with a tendency towards lower acceptance was selected by the participants because of its low relevance or dimension assignment. The decisive argument seemed to be the possibility to reduce the total number of indicators in order to reduce the complexity of the whole set (also compare chapter 4.3).

4.3 General feedback on indicator set

Overall, there was a very high acceptance (88.4% of participants) agreeing with the basic approach of assigning each criterion and associated indicator to one of the three dimensions of sustainability. Therefore no fundamental changes to the sustainability assessment and the hierarchical structure are necessary.

There were 30 individual comments concerning the use of the representation of sustainability by three dimensions, which can be summarized as follows:

1. 3-pillar model of sustainability outdated
2. Dimension assignment: not straightforward, arbitrary, not independent, more than one dimension
3. Hierarchy is manipulative

4. Equal number of criteria for each dimension
5. Too many social criteria

Although there are a large variety of different conceptual approaches to address sustainability, a substantial number of them is based on the the 3-pillar model or uses selected elements of it. Alternative approaches may open up new possibilities and perspectives; however they also have to be of operational use in the field of energy technology assessment, i.e. the underlying model must allow a consistent and adequate quantification of indicators. The issues of dimension assignment and hierarchy cannot be fully resolved in the sense that a complete agreement can be reached among all possible stakeholders, but an open and objective representation ensures transparency and comprehensibility. Finally, it should not be a primary aim to have a certain number or equal numbers of indicators per dimension, buth rather a comprehensive coverage of the different aspects for every dimension.

With regard to the total number of 40 indicators included in the full set, a slight majority considered the total number appropriate, but a strong minority of 44% considered it excessive (Figure 9). Figure 10 shows the distribution pattern of those 96 participants that proposed less than 40 criteria (22 ± 7; mean ± standard deviation).

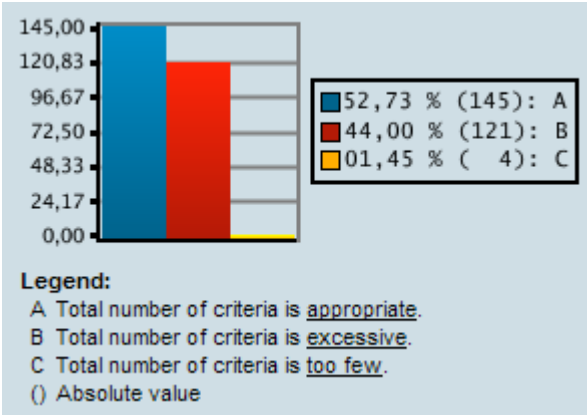


Figure 9 Appropriateness of the total number of indicators.

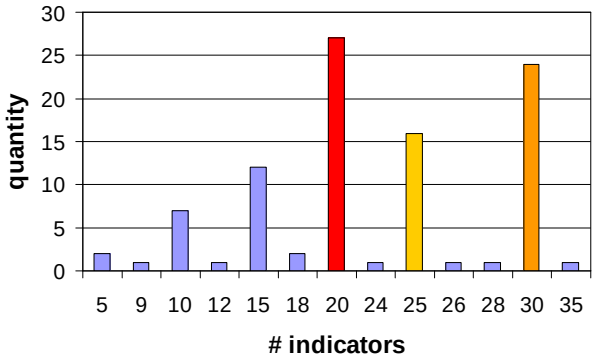


Figure 10 Proposed numbers of indicators for a reduced set (<40). The gold, orange and red bars indicate the top three nominations. The red bar also corresponds to the mean and mode value of the number of indicators.

Figures 11 and 12 show, which indicators the participants considered to be the most important and the least important, respectively. Figure 13 explains the labels A to AN used in Figures 11 and 12.

Concerning the most important indicators to be absolutely included in the final set of indicators, the following ones were selected most often:

- D ENV: Global warming potential – 66,55% (183)
- A ENV: Total consumption of fossil resources – 63.27% (174)
- L ECO: Average generation cost – 44,00% (121)
- G ENV: Impacts of air pollution on ecosystems – 29,09% (80)
- N ECO: Medium to long-term independence from foreign energy sources – 28,36% (78)
- AA SOC: Mortality due to normal operation – 26,18% (72)
- F ENV: Impacts of toxic substances on ecosystems – 18,55% (51)

Concerning the least important indicators to be absolutely excluded in the final set of indicators, the following ones were selected most often:

- AK SOC: Work qualifications: total years education for workforce – 40.36% (111)
- AJ SOC: Share of the effective electricity costs in the budget of a social welfare recipient – 25.82% (71)
- Q ECO: Construction time – 24.36% (67)
- AF SOC: Psychometric variables: personal control, catastrophic potential, perceived equity familiarity – 23.27% (64)
- AE SOC: Subjective health fears due to normal operation – 20.36% (56)
- AN SOC: Total traffic load – 20% (55)
- Y SOC: Willingness of NGOs and other citizen movements to act against the realisation of an option – 17.09% (47)
- AL SOC: Functional and aesthetic impact of energy infrastructure on landscape – 16% (44)
- AG SOC: Potential for a successful attack – 15.64% (43)

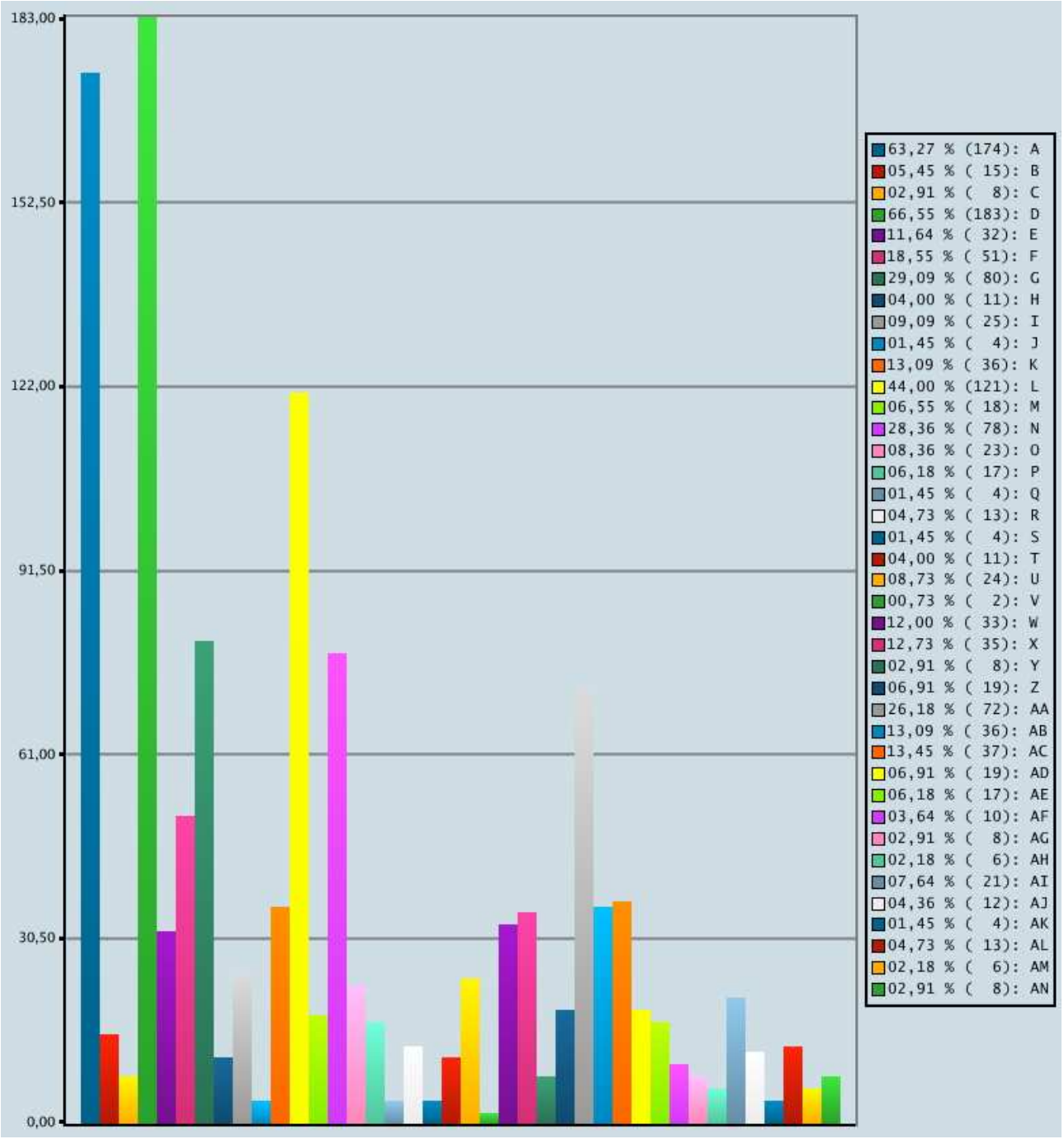


Figure 11 Indicator nominations if participants had to choose the five most important indicators to be absolutely included in the set.

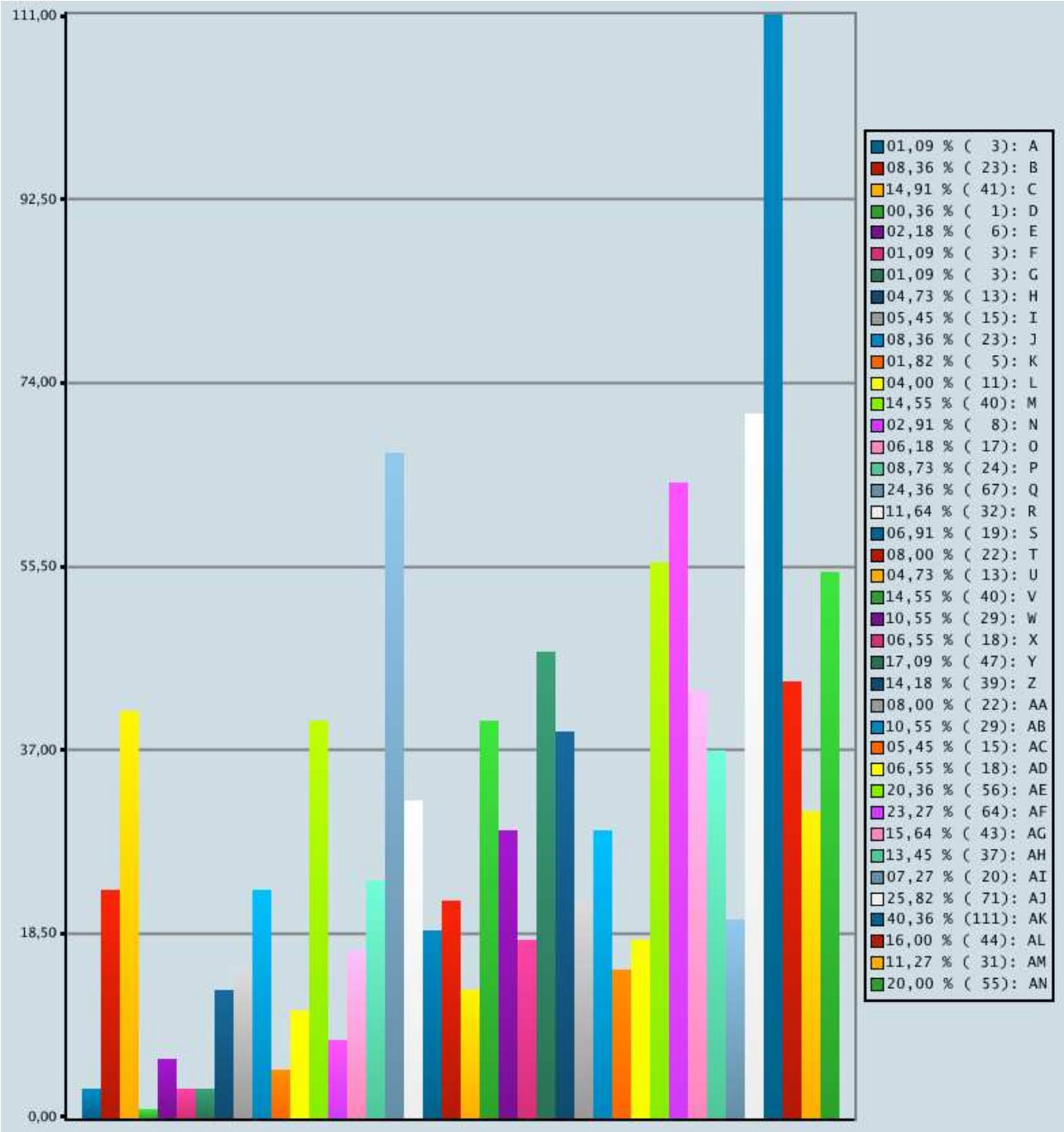


Figure 12 Indicator nominations if participants had to choose the five least important indicators to be absolutely excluded in the set.

Legend:

A	ENV: Total consumption of fossil resources
B	ENV: Total consumption of uranium
C	ENV: Weighted total consumption of metallic ores
D	ENV: Global warming potential
E	ENV: Impacts of land use on ecosystems
F	ENV: Impacts of toxic substances on ecosystems
G	ENV: Impacts of air pollution on ecosystems
H	ENV: Large release of hydrocarbons
I	ENV: Nuclear land contamination
J	ENV: Total weight of special chemical wastes stored in underground repositories
K	ENV: Total amount of medium and high level radioactive wastes to be stored in geological repositories
L	ECO: Average generation cost
M	ECO: Direct labour
N	ECO: Medium to long-term independence from foreign energy sources
O	ECO: Total capital cost
P	ECO: Ratio of the fuel cost to the generation cost
Q	ECO: Construction time
R	ECO: Total average variable cost or "dispatch cost"
S	ECO: Composite indicator
T	ECO: Equivalent availability factor
U	SOC: Market concentration in the primary energy supply
V	SOC: Probability that waste storage infrastructure will not be available
W	SOC: Flexibility to incorporate technological change
X	SOC: Potential of energy system induced conflicts
Y	SOC: Willingness of NGOs and other citizen movements to act against the realisation of an option
Z	SOC: Necessity of participative decision-making processes for different technologies
AA	SOC: Mortality due to normal operation
AB	SOC: Morbidity due to normal operation
AC	SOC: Expected mortality due to severe accidents
AD	SOC: Maximum credible number of fatalities per accident
AE	SOC: Subjective health fears due to normal operation
AF	SOC: Psychometric variables: personal control, catastrophic potential, perceived equity familiarity
AG	SOC: Potential for a successful attack
AH	SOC: Maximum credible effect of a successful attack
AI	SOC: Potential for misuse of technologies and substances within the nuclear energy chain
AJ	SOC: Share of the effective electricity costs in the budget of a social welfare recipient
AK	SOC: Work qualifications: total years education for workforce
AL	SOC: Functional and aesthetic impact of energy infrastructure on landscape
AM	SOC: Extent to which residents feel highly affected by noise
AN	SOC: Total traffic load
()	Absolute value

Figure 13 Overview of labels A to AN used in Figures 10 and 11.

Finally the participants were asked if they believe that some important indicators were missing in the set, and if so, which ones these are. Overall, 53 participants delivered suggestions and comments on this issue. Some proposals addressed the same or very similar topics and can thus be summarized as follows:

- Community development ("corporate citizenship")
- Direct biodiversity measure
- Aggregate mortality (normal operation + accidents)
- Impact of water use on ecosystems
- General liability insurance for nuclear is missing
- Fine particulates

4.4 Socio-demographic and personal questions

The intention of the section on socio-demographic and personal questions was to collect information on the social composition of the participants (Figures 14 to 17). Concerning the age of the participants, almost two thirds of them were falling into the range of 31 to 55 years, with age classes 41-45 and 46-50 having the largest contributions. A majority of 57.8% of the participants holds a doctorate and another 26.2% finished a master study. This finding is not surprising since the dominant stakeholder category was Researcher/Academia. With regard to gender distribution, more than 85% of the participants were men. Concerning the country of residence, persons living in Switzerland dominated, followed distantly by people from Germany, whereas French and Italian residents sum up to less than the total number of participants from all other countries combined.

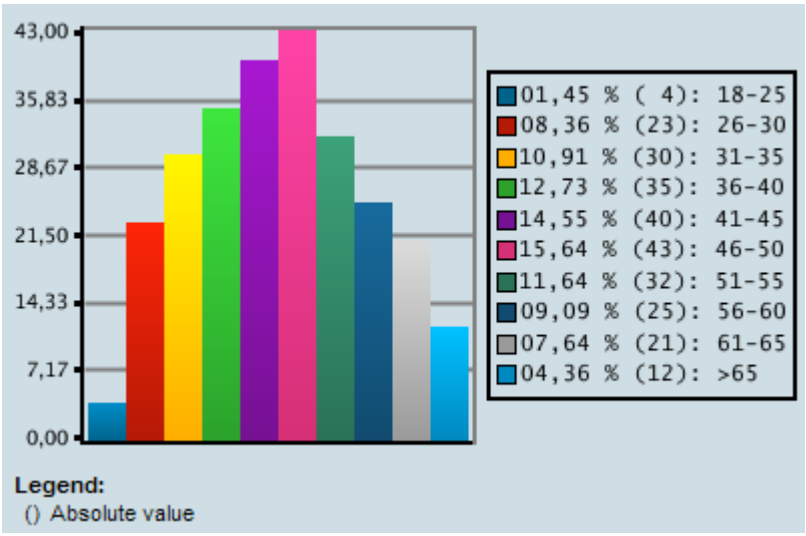


Figure 14 Assignment of participants to pre-defined age classes.

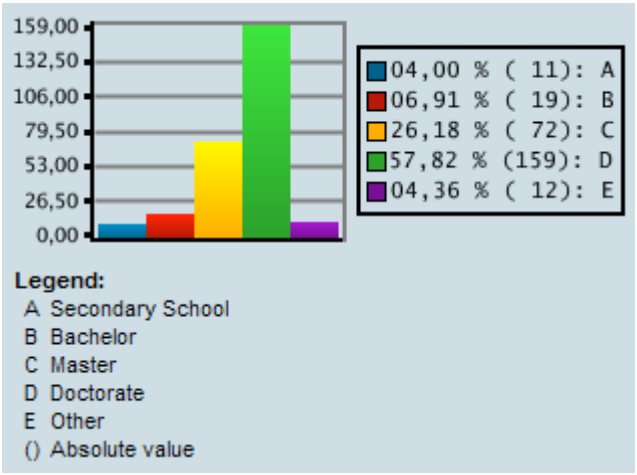


Figure 15 Highest level of education by individual participants.

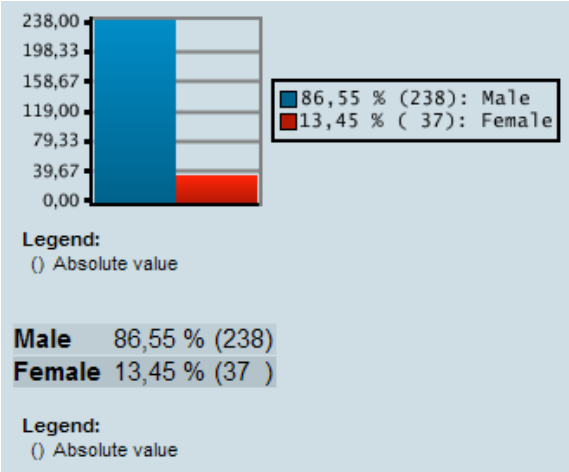


Figure 16 Gender of participants.

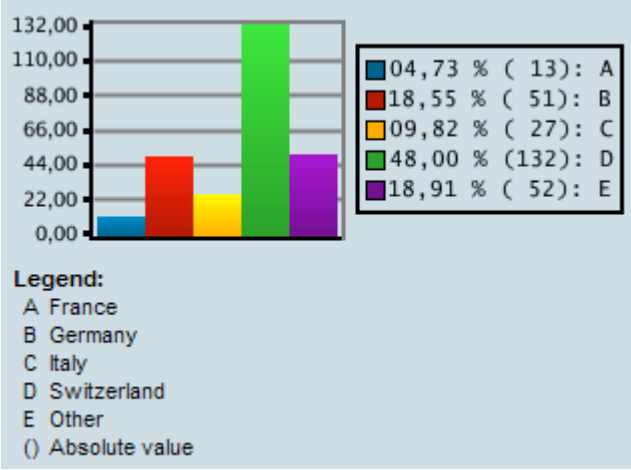


Figure 17 Break down of participants by country of residence.

4.5 Feedback on the questionnaire

At the end of the survey participants could give their feedback, which provides important information about the level of difficulty and related issues, which is shown in Figures 18 to 20. Over 70% of the participants assigned the difficulty of understanding the questionnaire in general to the categories Appropriate and Easy. However, when asking for the difficulty to specifically answer the questions, 48% choose Appropriate, but another 32% rated it Difficult. Finally, participants had to judge if there was sufficient information provided to understanding the questionnaire, i.e. to make it self-standing. About two thirds agreed, whereas about 28% expressed some doubt, but less than 3% disagreed. At the very end of the questionnaire the participants could add their individual comments, suggestions, and critics etc, which are given without any post-editing in the Appendix.

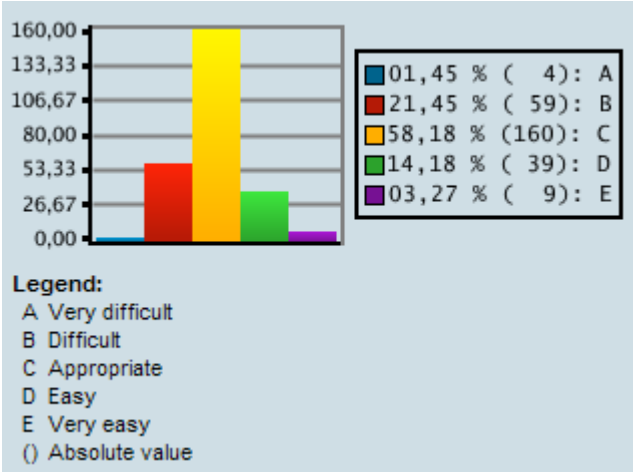


Figure 18 Difficulty of understanding the questionnaire in general.

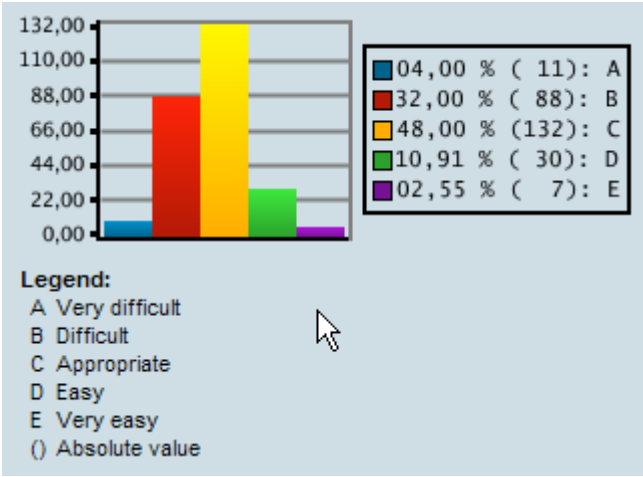


Figure 19 Difficulty of answering the individual questions.

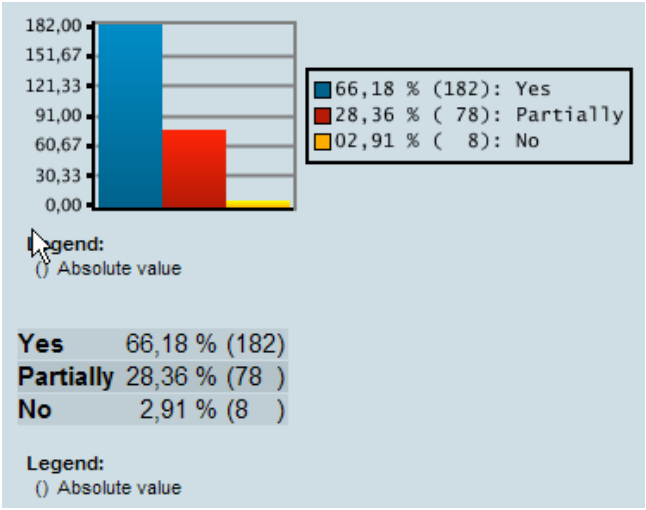


Figure 20 Amount of additional information provided to understanding the .questionnaire. Yes = sufficient, Partially = only partially satisfactory, No = insufficient.

5 Conclusions

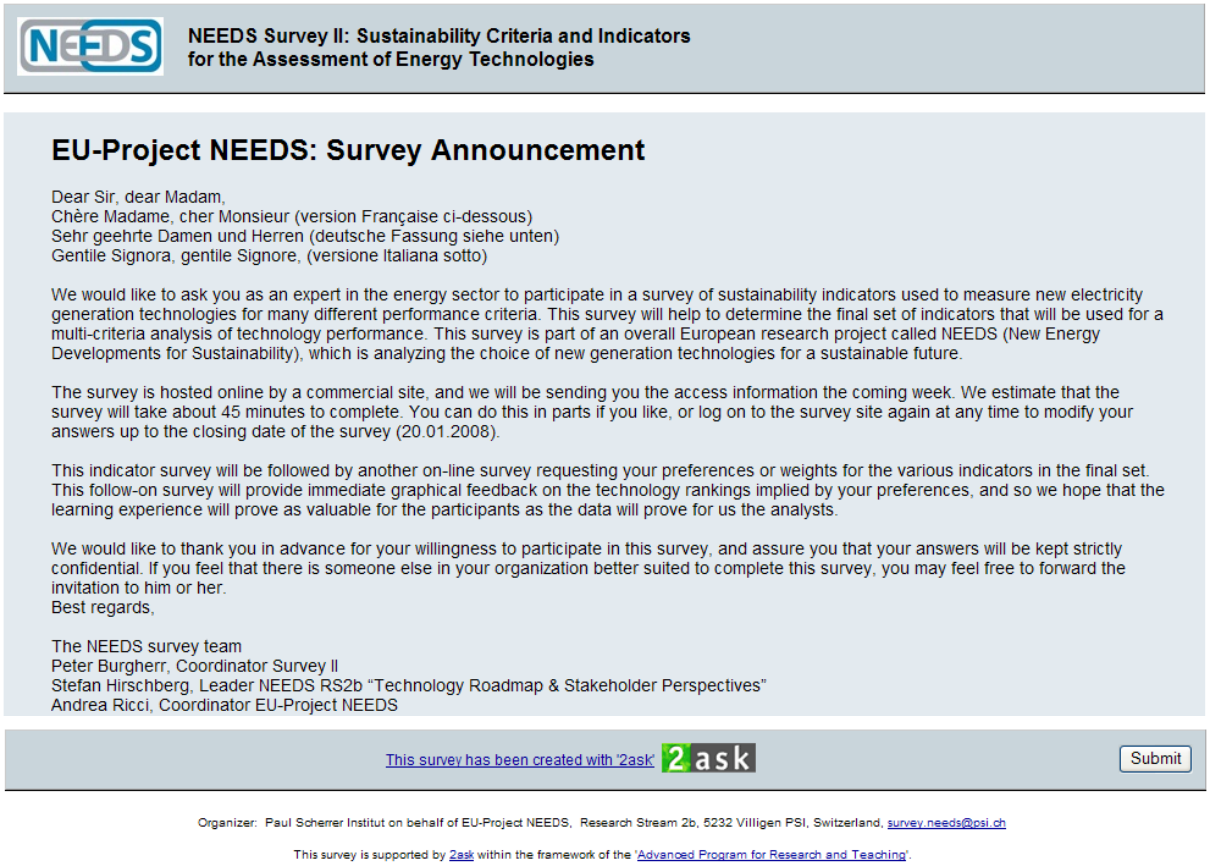
Survey II conclusions:

- The response rate of 9.7% was at the lower end of the expectations.
- The complexity and extent of the survey were rather demanding.
- The number of qualified people in the stakeholder database showed substantial variation among countries.
- Participants were mostly highly qualified and educated, but there was an over-representation of the category Researcher/Academia, however when comparing individual response rates of stakeholder categories this was less distinctive.
- In general the indicator set proposed within the NEEDS project found a wide acceptance.
- Only few individual indicators were considered controversial, and only what concerns their necessity, but not their relevance or dimension assignment.
- A quite strong minority (44%) of participants opted for fewer indicators; i.e. in the range of 20.
- Most participants were residents from Switzerland, and to a lesser extent from Germany, whereas France and Italy were substantially less represented.
- Overall, the survey confirmed that the proposed set of indicators is comprehensive and accurate for the sustainability assessment of energy technologies. Therefore, only few indicator descriptions were slightly modified to increase the level of clarity and understanding, but only one indicator – namely “Work Quality” – was eliminated.

Appendix

A.) Announcement

To raise the interest among the selected stakeholders and to possibly increase the response rate, Survey II was first introduced to potential participants by means of an “Announcement E-Mail” (Figure A1). Furthermore, this approach should give people the opportunity to provide feedback if they consider another person in their organization more suitable to answer the survey, or if they would like to propose additional people within their organization that should be included because of their knowledge and willingness to contribute to Survey II.



NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies

EU-Project NEEDS: Survey Announcement

Dear Sir, dear Madam,
Chère Madame, cher Monsieur (version Française ci-dessous)
Sehr geehrte Damen und Herren (deutsche Fassung siehe unten)
Gentile Signora, gentile Signore, (versione Italiana sotto)

We would like to ask you as an expert in the energy sector to participate in a survey of sustainability indicators used to measure new electricity generation technologies for many different performance criteria. This survey will help to determine the final set of indicators that will be used for a multi-criteria analysis of technology performance. This survey is part of an overall European research project called NEEDS (New Energy Developments for Sustainability), which is analyzing the choice of new generation technologies for a sustainable future.

The survey is hosted online by a commercial site, and we will be sending you the access information the coming week. We estimate that the survey will take about 45 minutes to complete. You can do this in parts if you like, or log on to the survey site again at any time to modify your answers up to the closing date of the survey (20.01.2008).

This indicator survey will be followed by another on-line survey requesting your preferences or weights for the various indicators in the final set. This follow-on survey will provide immediate graphical feedback on the technology rankings implied by your preferences, and so we hope that the learning experience will prove as valuable for the participants as the data will prove for us the analysts.

We would like to thank you in advance for your willingness to participate in this survey, and assure you that your answers will be kept strictly confidential. If you feel that there is someone else in your organization better suited to complete this survey, you may feel free to forward the invitation to him or her.
Best regards,

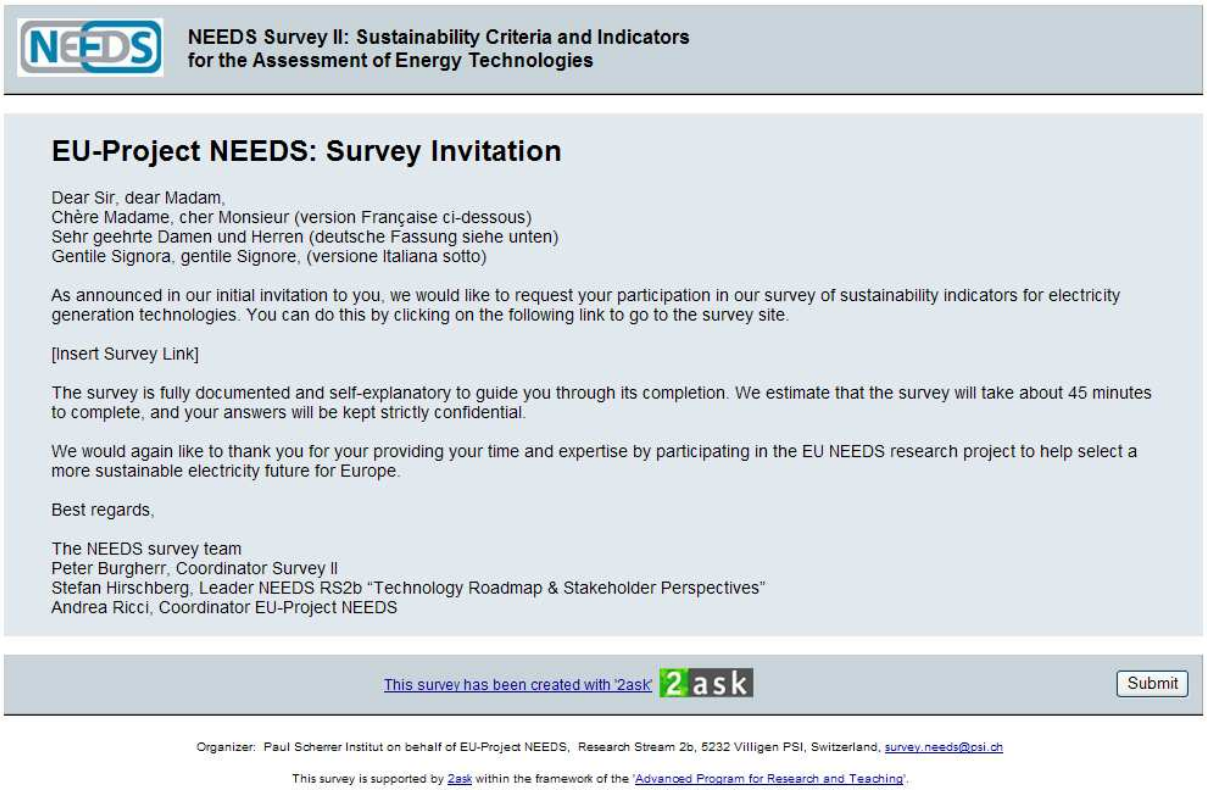
The NEEDS survey team
Peter Burgherr, Coordinator Survey II
Stefan Hirschberg, Leader NEEDS RS2b “Technology Roadmap & Stakeholder Perspectives”
Andrea Ricci, Coordinator EU-Project NEEDS

Figure A1 Announcement e-mail that was distributed to stakeholders to raise their interst in participating in Survey II.

B.) Invitation

The invitation e-mail (Figure B1) including information to access Survey II was sent out few days after the initial announcement. This mailing was based on a slightly modified Stakeholder Database because changes in e-mail addresses of some participants were taken into account as well as a number of newly proposed persons.

Invitations were distributed in such a way that each stakeholder received an e-mail with a personalized link to access the Survey. The use of a combined general internet link for the survey and a personalized TAN-code ensured that each participant can respond only once, and that reminder e-mails can only be sent to those persons who have not responded at a certain date during the survey period.



NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies

EU-Project NEEDS: Survey Invitation

Dear Sir, dear Madam,
Chère Madame, cher Monsieur (version Française ci-dessous)
Sehr geehrte Damen und Herren (deutsche Fassung siehe unten)
Gentile Signora, gentile Signore, (versione Italiana sotto)

As announced in our initial invitation to you, we would like to request your participation in our survey of sustainability indicators for electricity generation technologies. You can do this by clicking on the following link to go to the survey site.

[Insert Survey Link]

The survey is fully documented and self-explanatory to guide you through its completion. We estimate that the survey will take about 45 minutes to complete, and your answers will be kept strictly confidential.

We would again like to thank you for your providing your time and expertise by participating in the EU NEEDS research project to help select a more sustainable electricity future for Europe.

Best regards,

The NEEDS survey team
Peter Burgherr, Coordinator Survey II
Stefan Hirschberg, Leader NEEDS RS2b "Technology Roadmap & Stakeholder Perspectives"
Andrea Ricci, Coordinator EU-Project NEEDS

Figure B1 Invitation e-mail with access information (link to Survey II website) that was distributed to stakeholders.

C.) Reminder

Due to the personalized link assigned to each stakeholder, it is possible to send reminder e-mails specifically to those persons who have not answered the questionnaire at a certain date, i.e. unnecessary and bothering e-mail traffic can be avoided. The text for the reminder is shown in Figure C1.

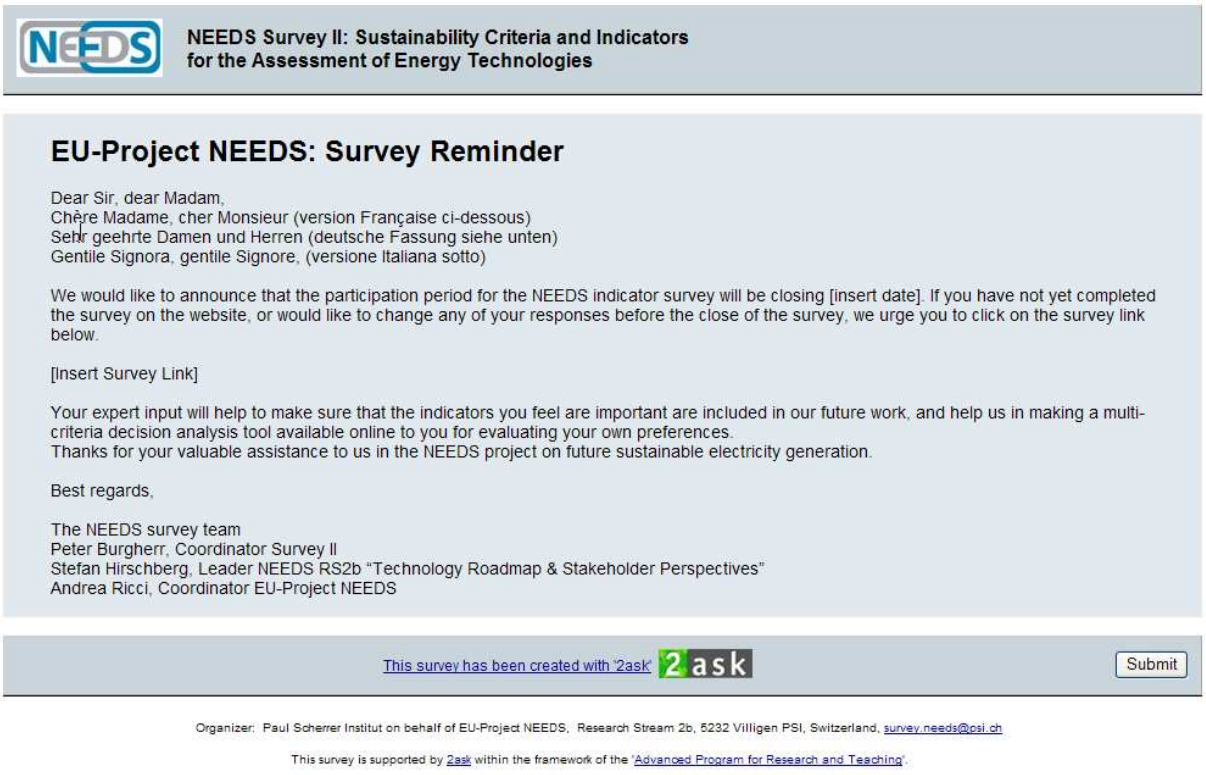


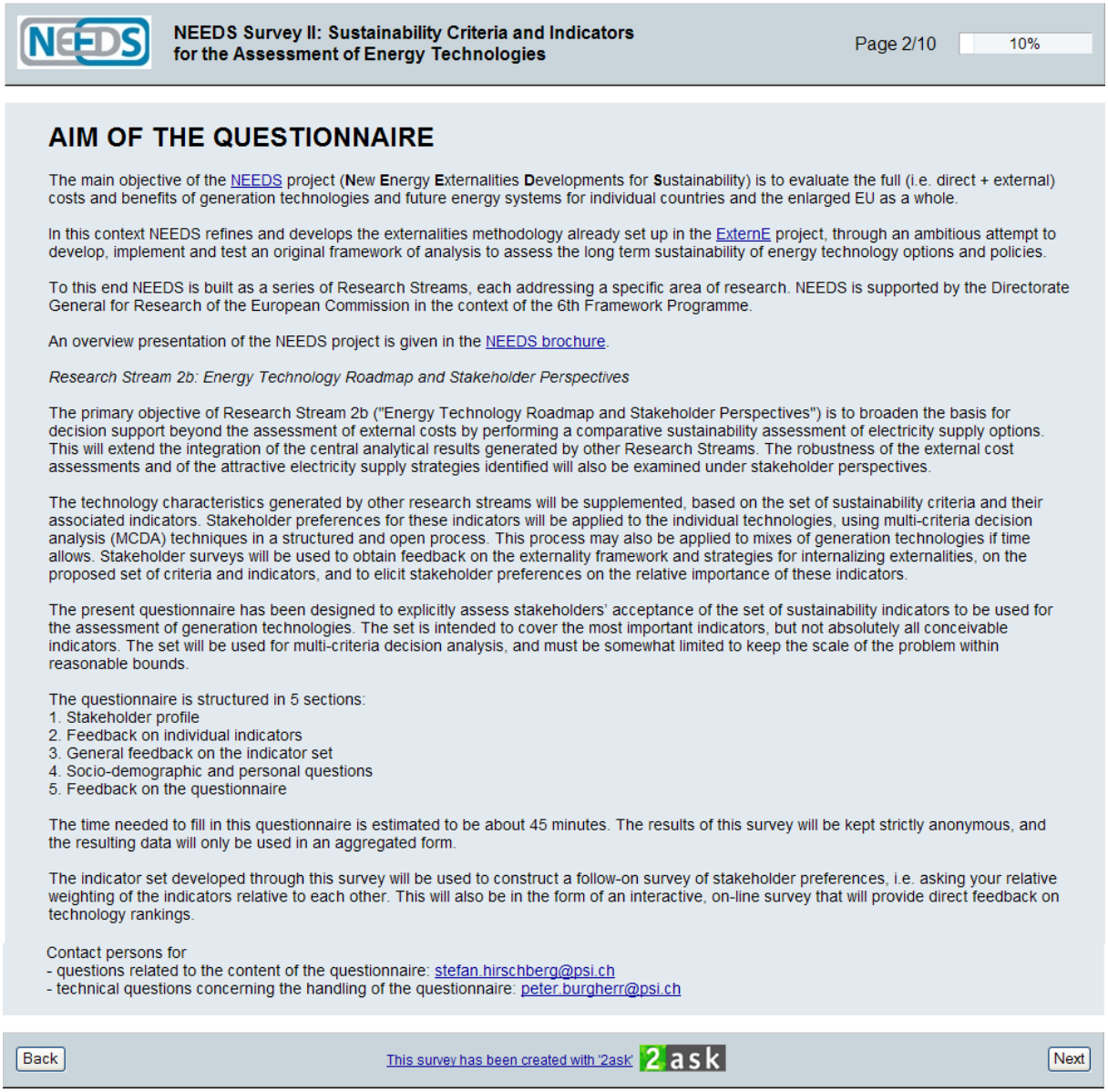
Figure C1 Reminder e-mail that was distributed to stakeholders that had not responded at a certain date.

D.) Questionnaire

The complete questionnaire is shown on the following pages (Figure D1). Note that each page of the questionnaire starts with a title ("Page X"), referring the page of the online version of Survey II.

Page 1:

Page 2:



NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies

Page 2/10 10%

AIM OF THE QUESTIONNAIRE

The main objective of the NEEDS project (**N**ew **E**nergy **E**xternalities **D**evelopments for **S**ustainability) is to evaluate the full (i.e. direct + external) costs and benefits of generation technologies and future energy systems for individual countries and the enlarged EU as a whole.

In this context NEEDS refines and develops the externalities methodology already set up in the ExternE project, through an ambitious attempt to develop, implement and test an original framework of analysis to assess the long term sustainability of energy technology options and policies.

To this end NEEDS is built as a series of Research Streams, each addressing a specific area of research. NEEDS is supported by the Directorate General for Research of the European Commission in the context of the 6th Framework Programme.

An overview presentation of the NEEDS project is given in the NEEDS brochure.

Research Stream 2b: Energy Technology Roadmap and Stakeholder Perspectives

The primary objective of Research Stream 2b ("Energy Technology Roadmap and Stakeholder Perspectives") is to broaden the basis for decision support beyond the assessment of external costs by performing a comparative sustainability assessment of electricity supply options. This will extend the integration of the central analytical results generated by other Research Streams. The robustness of the external cost assessments and of the attractive electricity supply strategies identified will also be examined under stakeholder perspectives.

The technology characteristics generated by other research streams will be supplemented, based on the set of sustainability criteria and their associated indicators. Stakeholder preferences for these indicators will be applied to the individual technologies, using multi-criteria decision analysis (MCDA) techniques in a structured and open process. This process may also be applied to mixes of generation technologies if time allows. Stakeholder surveys will be used to obtain feedback on the externality framework and strategies for internalizing externalities, on the proposed set of criteria and indicators, and to elicit stakeholder preferences on the relative importance of these indicators.

The present questionnaire has been designed to explicitly assess stakeholders' acceptance of the set of sustainability indicators to be used for the assessment of generation technologies. The set is intended to cover the most important indicators, but not absolutely all conceivable indicators. The set will be used for multi-criteria decision analysis, and must be somewhat limited to keep the scale of the problem within reasonable bounds.

The questionnaire is structured in 5 sections:
1. Stakeholder profile
2. Feedback on individual indicators
3. General feedback on the indicator set
4. Socio-demographic and personal questions
5. Feedback on the questionnaire

The time needed to fill in this questionnaire is estimated to be about 45 minutes. The results of this survey will be kept strictly anonymous, and the resulting data will only be used in an aggregated form.

The indicator set developed through this survey will be used to construct a follow-on survey of stakeholder preferences, i.e. asking your relative weighting of the indicators relative to each other. This will also be in the form of an interactive, on-line survey that will provide direct feedback on technology rankings.

Contact persons for
- questions related to the content of the questionnaire: stefan.hirschberg@psi.ch
- technical questions concerning the handling of the questionnaire: peter.burgherr@psi.ch

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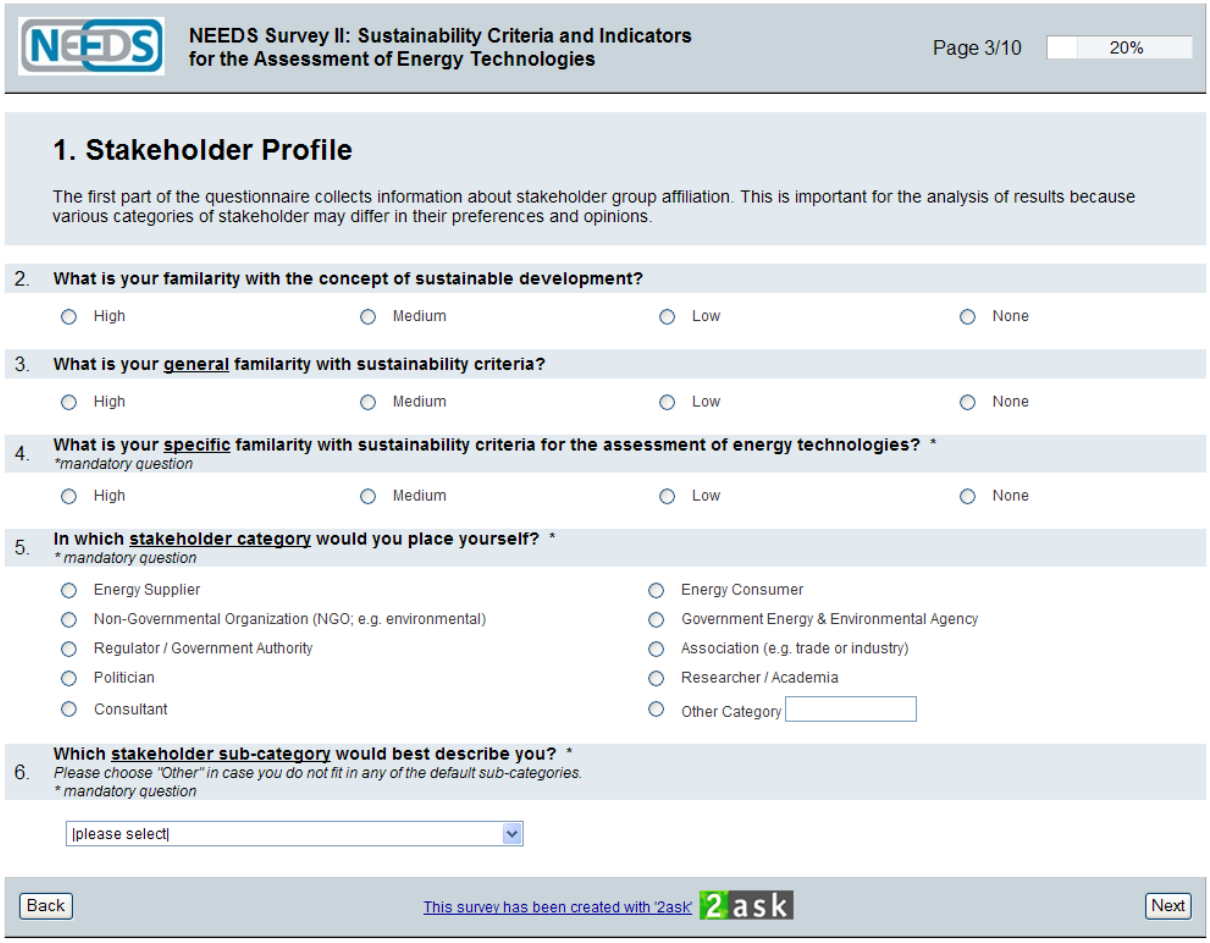
Page 3:



NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies

Page 3/10 20%

1. Stakeholder Profile

The first part of the questionnaire collects information about stakeholder group affiliation. This is important for the analysis of results because various categories of stakeholder may differ in their preferences and opinions.

2. **What is your familarity with the concept of sustainable development?**

○ High ○ Medium ○ Low ○ None

3. **What is your general familarity with sustainability criteria?**

○ High ○ Medium ○ Low ○ None

4. **What is your specific familarity with sustainability criteria for the assessment of energy technologies?** *
**mandatory question*

○ High ○ Medium ○ Low ○ None

5. **In which stakeholder category would you place yourself?** *
** mandatory question*

○ Energy Supplier
○ Non-Governmental Organization (NGO; e.g. environmental)
○ Regulator / Government Authority
○ Politician
○ Consultant
○ Energy Consumer
○ Government Energy & Environmental Agency
○ Association (e.g. trade or industry)
○ Researcher / Academia
○ Other Category

6. **Which stakeholder sub-category would best describe you?** *
Please choose "Other" in case you do not fit in any of the default sub-categories.
** mandatory question*

|please select|

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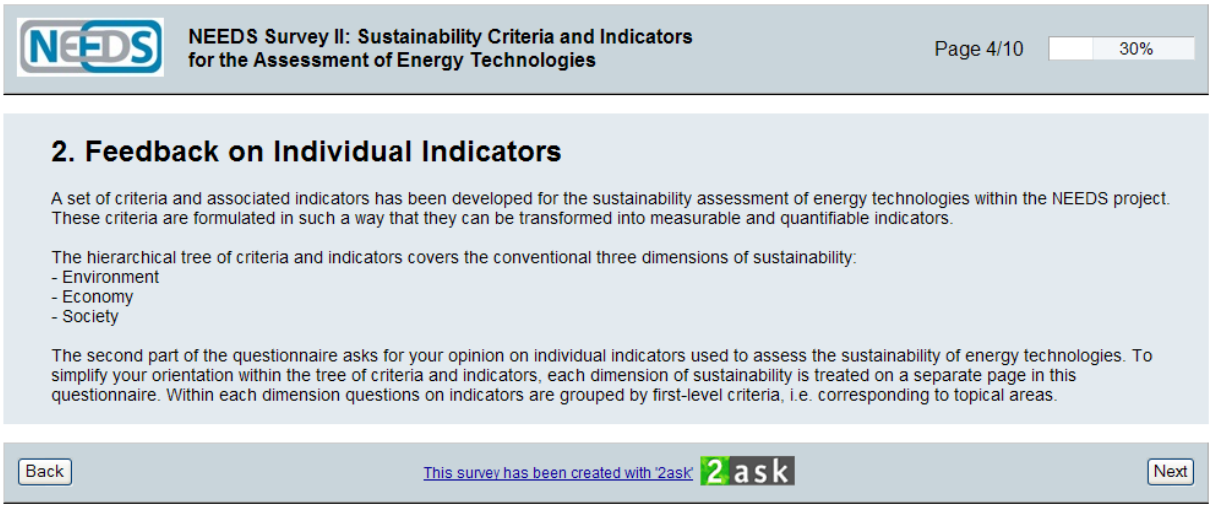
Page 4:



NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies

Page 4/10 30%

2. Feedback on Individual Indicators

A set of criteria and associated indicators has been developed for the sustainability assessment of energy technologies within the NEEDS project. These criteria are formulated in such a way that they can be transformed into measurable and quantifiable indicators.

The hierarchical tree of criteria and indicators covers the conventional three dimensions of sustainability:
- Environment
- Economy
- Society

The second part of the questionnaire asks for your opinion on individual indicators used to assess the sustainability of energy technologies. To simplify your orientation within the tree of criteria and indicators, each dimension of sustainability is treated on a separate page in this questionnaire. Within each dimension questions on indicators are grouped by first-level criteria, i.e. corresponding to topical areas.

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Page 5:

NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies

Page 5/10 40%

2.1 Environmental dimension

The indicators of the environmental dimension are grouped by first-level criteria into four topical areas:
- Resources
- Climate Change
- Impact on Ecosystems
- Wastes

For each question you will find the lower criterion hierarchy (second- and/or third-level) in the title, followed by a brief description.
The associated indicator name and unit is given to the left of the answer matrix.

Please answer three different questions for each indicator:

Relevance: Is the indicator relevant for the sustainability assessment of energy technologies?

Necessity: Should the indicator be included in the final set of indicators or not?
Not all strictly relevant indicators may be included for practical reasons - i.e. the relative balance between the number of economic, environmental and social indicators, and the total size of the multi-criteria analysis problem.

Dimension assignment: Do you believe that the indicator should be moved to another dimension of sustainability? If you agree with the current assigned dimension, you do not have to answer this question. If you do not agree, select one of the two other dimensions of sustainability.

RESOURCES

Energy resources / Fossil primary energy

7. *This criterion measures the total primary energy in the fossil resources used for the production of 1 kWh of electricity. It includes the total coal, natural gas and crude oil used for each complete electricity generation technology chain.*
Note: For example the coal fired technologies also include the energy from oil for transportation, and from natural gas in the electricity mix used for mining and processing.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Total consumption of fossil resources [MJ/kWh]	○	○	○	○	○	○	○	○	○

Energy resources / Total consumption of uranium

8. *This criterion quantifies the primary energy from uranium used to produce 1 kWh of electricity. It includes the total use of uranium for each complete electricity generation technology chain.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Total consumption of uranium [MJ/kWh]	○	○	○	○	○	○	○	○	○

Mineral resources (ores)

9. *This criterion quantifies the use of selected scarce metals used to produce 1 kWh of electricity. It is based on the Life Cycle Impact Assessment method "CML 2001". The use of all single metals is expressed in antimony-equivalents, based on the scarcity of their ores relative to the reference ore (antimony). The indicator covers each complete electricity generation technology chain.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Weighted total consumption of metallic ores [kg(Sb-eq.)/kWh]	○	○	○	○	○	○	○	○	○

CLIMATE CHANGE

Greenhouse gas emissions

10. *This criterion includes the total for all different greenhouse gases expressed in kg of CO_2 equivalent for each electricity generation technology chain. It addresses the potential negative impacts of global climate change caused by the greenhouse gases from the production of 1 kWh of electricity.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Global warming potential [kg(CO_2-eq.)/kWh]	○	○	○	○	○	○	○	○	○

IMPACT ON ECOSYSTEMS

Impacts from normal operation / Land use

11. *This criterion quantifies the loss of species (flora & fauna) due to the land used to produce 1 kWh of electricity. The "potentially damaged fraction" (PDF) of species is multiplied by land area and years for each complete electricity generation technology chain.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Impacts of land use on ecosystems [PDF*m^2*a/kWh]	○	○	○	○	○	○	○	○	○

Impacts from normal operation / Ecotoxicity

12. *This criterion quantifies the loss of species (flora & fauna) due to ecotoxic substances released to air, water and soil to produce 1 kWh of electricity. The "potentially damaged fraction" (PDF) of species is multiplied by land area and years for each complete electricity generation technology chain.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Impacts of toxic substances on ecosystems [PDF*m^2*a/kWh]	○	○	○	○	○	○	○	○	○

Impacts from normal operation / Acidification and eutrophication

13. *This criterion quantifies the loss of species (flora & fauna) due to acidification and eutrophication caused by pollution from production of 1 kWh of electricity. The "potentially damaged fraction" (PDF) of species is multiplied by land area and years for each complete electricity generation technology chain.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Impacts of air pollution on ecosystems [PDF*m^2*a/kWh]	○	○	○	○	○	○	○	○	○

Impacts from severe accidents / Release of hydrocarbons

14. *This criterion quantifies large accidental spills of hydrocarbons to the environment, which can potentially damage affected ecosystems. It considers severe accidents only, i.e. releases of at least 10000 tonnes.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Large release of hydrocarbons [t/kWh]	○	○	○	○	○	○	○	○	○

Impacts from severe accidents / Land contamination

15. *This criterion quantifies land contaminated due to accidents releasing radioactive isotopes. The land area contaminated is estimated using Probabilistic Safety Analysis (PSA). Note that this indicator is restricted to the nuclear electricity generation technology chain.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Nuclear land contamination [km^2/kWh]	○	○	○	○	○	○	○	○	○

WASTES

Special chemical wastes stored in underground repositories

16. *This criterion quantifies the total mass of special chemical wastes stored in underground repositories due to the production of 1 kWh of electricity. It covers each complete electricity generation technology chain and does not reflect actual damage to humans or nature. It also does not reflect the confinement time required for each repository.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Total weight of special chemical wastes stored in underground repositories [kg/kWh]	○	○	○	○	○	○	○	○	○

Medium and high level radioactive wastes to be stored in geological repositories

17. *This criterion quantifies the volume of medium and high level radioactive wastes stored in underground repositories due to the production of 1 kWh of electricity. It covers each complete electricity generation technology chain and does not reflect actual damage to humans or nature. It also does not reflect the confinement time required for the repository.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Economic	Social
Indicator: Total amount of medium and high level radioactive wastes to be stored in geological repositories [m^3/kWh]	○	○	○	○	○	○	○	○	○

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Page 6:

NEEDS Survey II: Sustainability Criteria and Indicators for the Assessment of Energy Technologies Page 6/10 50%

2.2 Economic dimension

The indicators of the economic dimension are grouped by first-level criteria into three topical areas:
- Impacts on Customers
- Impacts on Overall Economy
- Impacts on Utility

For each question you will find the lower criterion hierarchy (second- and/or third-level) in the title, followed by a brief description.
The associated indicator name and unit is given to the left of the answer matrix.

Please answer three different questions for each indicator:

Relevance: Is the indicator relevant for the sustainability assessment of energy technologies?

Necessity: Should the indicator be included in the final set of indicators or not?
Not all strictly relevant indicators may be included for practical reasons - i.e. the relative balance between the number of economic, environmental and social indicators, and the total size of the multi-criteria analysis problem.

Dimension assignment: Do you believe that the indicator should be moved to another dimension of sustainability? If you agree with the current assigned dimension, you do not have to answer this question. If you do not agree, select one of the two other dimensions of sustainability.

IMPACTS ON CUSTOMERS

Price of electricity

18. *This criterion gives the cost of electricity to the utility for each technology (not the price of electricity to the customer). It is the average cost of generation per kilowatt-hour (kWh), including the capital cost of the plant, fuel, and operation and maintenance costs.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Average generation cost [EUR/MWh]	○	○	○	○	○	○	○	○	○

IMPACTS ON OVERALL ECONOMY

Employment

19. *This criterion gives the amount of employment directly related to building and operating the generating technology in question, including the direct labour involved in extracting or harvesting and transporting fuels (when applicable). Indirect labour (such as fabricating plant components) is not included. The employment is measured in terms of man-years of labour and averaged over the generation, i.e. units are person-years/GWh.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Direct labour [Person-years/GWh]	○	○	○	○	○	○	○	○	○

Autonomy of electricity generation

20. *Utility companies and the societies they serve may be vulnerable to interruptions in service if imported fuels are unavailable due to economic or political problems related to energy resource availability. This measure of vulnerability is based on expert judgment (of related factors), including whether a resource is domestic or imported, renewable or finite, and the relative size of different finite resources.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Medium to long-term independence from foreign energy sources [Ordinal scale]	○	○	○	○	○	○	○	○	○

IMPACTS ON UTILITY

Financial risks / Capital investment exposure

21. *Utility companies can face a considerable financial risk if the total cost of a new electricity generating plant is very large compared to the overall size of the company. These risks can require forming necessary partnerships with other utilities or raising capital through financial markets.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Total capital cost [EUR]	○	○	○	○	○	○	○	○	○

Financial risks / Impact of fuel price changes

22. *The fraction of fuel cost to overall generation cost can range from zero (solar PV) to low (nuclear power) to high (gas turbines). This fraction therefore indicates how sensitive the generation costs would be to a change in fuel prices.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Ratio of the fuel cost to the generation cost [Fraction]	○	○	○	○	○	○	○	○	○

Financial risks / Risk due to changes in boundary conditions

23. *Once a utility has started building a plant it is vulnerable to public opposition, resulting in delays and other problems, driving up the total cost (question 20 above). This indicator therefore gives the expected plant construction time in years. Time required for planning and regulatory approval is not included, as the bulk of spending occurs after the start of construction.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Construction time [Years]	○	○	○	○	○	○	○	○	○

Operation / "Merit order" for dispatch purposes

24. *Generating companies "dispatch" or order their plants into operation according to their variable cost, starting with the lowest cost baseload plants up to the highest cost plants at peak load periods. This variable (or dispatch) cost is the cost to run the plant, without the cost to build it. It is equal to the average fuel cost plus variable operation and maintenance costs per kilowatt-hour.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Total average variable cost or "dispatch cost" [Eurocent/kWh]	○	○	○	○	○	○	○	○	○

Operation / Flexibility of dispatch

25. *In order to plan the operation of their generating plants at least a day in advance, utilities need forecasts of generation they cannot control (renewable resources like wind and solar), and the necessary start-up and shut-down times required for the plants they can control. This indicator combines these two measures of planning flexibility, based on expert judgment, including the logarithmic nature of planning time (the difference between 1 and 2 hours advance notice is more important in planning than the difference between 11 and 12 hours).*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Composite indicator [Ordinal scale]	○	○	○	○	○	○	○	○	○

Operation / Availability

26. *All technologies can have plant outages or partial outages (less than full generation), due to either equipment failures (forced outages) or due to maintenance (unforced or planned outages). This indicator tells the fraction of the time that the generating plant is available to generate power. Partial outages are accounted for by making an annual average equivalent availability factor, equal to the expected possible annual generation divided by maximum annual generation at full power.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Social
Indicator: Equivalent availability factor [Fraction]	○	○	○	○	○	○	○	○	○

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2.3 Social dimension

The indicators of the social dimension are grouped by first-level criteria into four topical areas:
- Security / reliability of energy provision
- Political stability and legitimacy
- Social and individual risks
- Quality of life

For each question you will find the lower criterion hierarchy (second- and/or third-level) in the title, followed by a brief description.
The associated indicator name and unit is given to the left of the answer matrix.

Please answer three different questions for each indicator:

Relevance: Is the indicator relevant for the sustainability assessment of energy technologies?

Necessity: Should the indicator be included in the final set of indicators or not?
Not all strictly relevant indicators may be included for practical reasons - i.e. the relative balance between the number of economic, environmental and social indicators, and the total size of the multi-criteria analysis problem.

Dimension assignment: Do you believe that the indicator should be moved to another dimension of sustainability? If you agree with the current assigned dimension, you do not have to answer this question. If you do not agree, select one of the two other dimensions of sustainability.

SECURITY / RELIABILITY OF ENERGY PROVISION

Political threats to continuity of energy service / Diversity of primary energy suppliers

27. *This criterion refers to the market concentration of energy suppliers in each primary energy sector that could lead to economic or political disruption. It is based on expert judgement.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Market concentration in the primary energy supply [Ordinal scale]	○	○	○	○	○	○	○	○	○

Political threats to continuity of energy service / Waste management

28. *The criterion is based on the possibility that an infrastructure of storage facilities will not be available in time to take deliveries of waste materials from the fuel chain, including from the fuel supply, plant construction, operation and decommissioning of the plant.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Probability that waste storage infrastructure will not be available [Ordinal scale]	○	○	○	○	○	○	○	○	○

Flexibility and adaptation

29. *The criterion refers to the technical characteristics of each electricity generation technology that may make it flexible in implementing technical progress and innovations.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Flexibility to incorporate technological change [Ordinal scale]	○	○	○	○	○	○	○	○	○

POLITICAL STABILITY AND LEGITIMACY

Potential of conflicts induced by energy systems

30. *The indicator refers to conflicts that are based on historical evidence. It is related to the characteristics of energy systems that trigger conflicts.*

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Potential of energy system induced conflicts [Ordinal scale]	○	○	○	○	○	○	○	○	○

31. **Willingness to act (mobilization potential)**

This criterion is based on the potential mobilization (i.e., opposition) of public opinion, including protests, petitions, signature drives, etc.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Willingness of NGOs and other citizen movements to act against the realisation of an option [Ordinal scale]	○	○	○	○	○	○	○	○	○

32. **Necessity of participative decision-making processes**

This criterion is based on the fact that certain types of technologies require public, participative decision-making processes, especially for construction or operating permits or licenses.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Necessity of participative decision-making processes for different technologies [Ordinal scale]	○	○	○	○	○	○	○	○	○

SOCIAL AND INDIVIDUAL RISKS

33. **Expert-based risk estimates for normal operation / Reduced life expectancy due to normal operation**

This criterion is based on the increased rate of mortality due to normal operation of the electricity generation technology and its associated energy chain. It is measured in the years of life lost (YOLL) by the entire population, compared to the expected lifetimes without the technology in question.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Mortality due to normal operation [YOLL/kWh]	○	○	○	○	○	○	○	○	○

34. **Expert-based risk estimates for normal operation / Non-fatal illnesses due to normal operation**

This criterion is based on the increased rate of sickness or morbidity due to normal operation of the electricity generation technology and its associated energy chain. It is measured in the years of life affected by disabilities (disability affected life years, or DALY) suffered by the entire population, compared to their expected health without the technology in question.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Morbidity due to normal operation [DALY/kWh]	○	○	○	○	○	○	○	○	○

35. **Expert-based risk estimates for accidents / Expected health effects from accidents**

This criterion is based on the number of fatalities expected for each kWh of electricity that occur in severe accidents with 5 or more deaths per accident for a particular electricity generation technology chain.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Expected mortality due to severe accidents [Fatalities/kWh]	○	○	○	○	○	○	○	○	○

36. **Expert-based risk estimates for accidents / Maximum consequences of accidents**

This criterion is based on the maximum number of fatalities that are reasonably credible for a single accident for a particular electricity generation technology chain.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Maximum credible number of fatalities per accident [Fatalities/accident]	○	○	○	○	○	○	○	○	○

37. **Perceived risks / Perceived risk characteristics for normal operation**

This criterion is based on citizens' fear of negative health effects due to normal operation of the electricity generation technology.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Subjective health fears due to normal operation [Ordinal scale]	○	○	○	○	○	○	○	○	○

38. **Perceived risks / Perceived risk characteristics for accidents**

This criterion is based on citizens' perception of risk characteristics, including whether they can control the risk personally, whether the potential damage is small or catastrophic, and their familiarity with the risk.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Psychometric variables such as personal control, catastrophic potential, perceived equity, familiarity [Ordinal scale]	○	○	○	○	○	○	○	○	○

39. **Terrorist threat / Potential of attack**

This criterion indicates the potential for a successful terrorist attack on a specific technology, based on its vulnerability, the potential damage and public perception of risk.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Potential for a successful attack [Ordinal scale]	○	○	○	○	○	○	○	○	○

40. **Terrorist threat / Effect of a successful attack**

This criterion concerns the potential maximum consequences of a successful terrorist attack. The criterion implicitly addresses the aversion towards low-probability high-consequence accidents.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Maximum credible effect of a successful attack [Expected number of fatalities]	○	○	○	○	○	○	○	○	○

41. **Terrorist threat / Proliferation**

This criterion represents the potential for misuse of technologies or substances present in the nuclear electricity generation technology chain, based on both their presence and the risk of such misuse or diversion.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Potential for misuse of technologies and substances within the nuclear energy chain [Ordinal scale]	○	○	○	○	○	○	○	○	○

QUALITY OF LIFE

42. Socially compatible development / Equitable life conditions

This criterion gives the average fraction of the budget dedicated to electricity by someone receiving social welfare.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Share of the effective electricity costs in the budget of a social welfare recipient [%]	○	○	○	○	○	○	○	○	○

43. Socially compatible development / Work quality

This criterion is based on the amount of knowledge and training required by the average worker employed by a particular electricity generation technology chain.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Work qualifications: average years education for workforce [Ordinal Scale]	○	○	○	○	○	○	○	○	○

44. Effects on the quality of landscape and residential area / Effects on the quality of landscape

This criterion is based on the overall functional and aesthetic impact on the landscape of the entire infrastructure related to each electricity generation technology chain, including mines, transmission lines or pipelines, structures, etc.
Note: Excludes traffic.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Functional and aesthetic impact of energy infrastructure on landscape [Ordinal scale]	○	○	○	○	○	○	○	○	○

45. Effects on the quality of landscape and residential area / Noise exposure

This criterion is based on the amount of noise caused by the generation plant, as well as transport of materials to and from the plant (e.g. trucking of fuel and/or waste).

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Extent to which residents feel highly affected by noise [Ordinal scale]	○	○	○	○	○	○	○	○	○

46. Effects on the quality of landscape and residential area / Contribution to traffic

This criterion quantifies the freight traffic by lorry and train caused by the production of 1 kWh electricity. The criterion covers the most relevant parts of each electricity generation technology chain considering freight traffic.

	Relevance					Necessity		Move to other sustainability dimension	
	Very high	High	Medium	Low	Very Low	Include	Do not include	Environmental	Economic
Indicator: Total traffic load [tkm/kWh]	○	○	○	○	○	○	○	○	○

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3. General Feedback on Indicator Set

The third part of the questionnaire addresses general aspects of the indicator set:
- Do you agree with the chosen approach and the number of indicators?
- Which indicators do you consider most and least important, respectively?
- Are any indicators missing in your opinion?

47. **Do you agree with the basic approach of assigning each criterion and associated indicator to one of the three dimensions of sustainability?**

- ○ Yes
- ○ No (please add your reason(s) if you would like)

48. **What is your opinion on the total number of criteria in the full set (40 criteria) for the assessment of electricity generation technologies?**

- ○ Total number of criteria is appropriate.
- ○ Total number of criteria is excessive.
- ○ Total number of criteria is too few.

If you have chosen 'excessive' or 'too few', please indicate roughly the total number of criteria you consider appropriate:

49. **If you had to pick the 5 most important indicators to be absolutely INCLUDED in the final set of indicators, which indicators would these be?**
Note that the three letter abbreviation at the beginning of each indicator indicates the sustainability dimension. ENV: environmental dimension, ECO: economic dimension, SOC: social dimension.

- ☐ ENV: Total consumption of fossil resources
- ☐ ENV: Total consumption of uranium
- ☐ ENV: Weighted total consumption of metallic ores
- ☐ ENV: Global warming potential
- ☐ ENV: Impacts of land use on ecosystems
- ☐ ENV: Impacts of toxic substances on ecosystems
- ☐ ENV: Impacts of air pollution on ecosystems
- ☐ ENV: Large release of hydrocarbons
- ☐ ENV: Nuclear land contamination
- ☐ ENV: Total weight of special chemical wastes stored in underground repositories
- ☐ ENV: Total amount of medium and high level radioactive wastes to be stored in geological repositories
- ☐ ECO: Average generation cost
- ☐ ECO: Direct labour
- ☐ ECO: Medium to long-term independence from foreign energy sources
- ☐ ECO: Total capital cost
- ☐ ECO: Ratio of the fuel cost to the generation cost
- ☐ ECO: Construction time
- ☐ ECO: Total average variable cost or "dispatch cost"
- ☐ ECO: Composite indicator
- ☐ ECO: Equivalent availability factor
- ☐ SOC: Market concentration in the primary energy supply
- ☐ SOC: Probability that waste storage infrastructure will not be available
- ☐ SOC: Flexibility to incorporate technological change
- ☐ SOC: Potential of energy system induced conflicts
- ☐ SOC: Willingness of NGOs and other citizen movements to act against the realisation of an option
- ☐ SOC: Necessity of participative decision-making processes for different technologies
- ☐ SOC: Mortality due to normal operation
- ☐ SOC: Morbidity due to normal operation
- ☐ SOC: Expected mortality due to severe accidents
- ☐ SOC: Maximum credible number of fatalities per accident
- ☐ SOC: Subjective health fears due to normal operation
- ☐ SOC: Psychometric variables: personal control, catastrophic potential, perceived equity familiarity
- ☐ SOC: Potential for a successful attack
- ☐ SOC: Maximum credible effect of a successful attack
- ☐ SOC: Potential for misuse of technologies and substances within the nuclear energy chain
- ☐ SOC: Share of the effective electricity costs in the budget of a social welfare recipient
- ☐ SOC: Work qualifications: total years education for workforce
- ☐ SOC: Functional and aesthetic impact of energy infrastructure on landscape
- ☐ SOC: Extent to which residents feel highly affected by noise
- ☐ SOC: Total traffic load

50. **If you had to pick the 5 least important indicators to be absolutely EXCLUDED in the final set of indicators, which indicators would these be?**
Note that the three letter abbreviation at the beginning of each indicator indicates the sustainability dimension. ENV: environmental dimension, ECO: economic dimension, SOC: social dimension.

- ☐ ENV: Total consumption of fossil resources
- ☐ ENV: Weighted total consumption of metallic ores
- ☐ ENV: Impacts of land use on ecosystems
- ☐ ENV: Impacts of air pollution on ecosystems
- ☐ ENV: Nuclear land contamination
- ☐ ENV: Total amount of medium and high level radioactive wastes to be stored in geological repositories
- ☐ ECO: Direct labour
- ☐ ECO: Total capital cost
- ☐ ECO: Construction time
- ☐ ECO: Composite indicator
- ☐ SOC: Market concentration in the primary energy supply
- ☐ SOC: Flexibility to incorporate technological change
- ☐ SOC: Willingness of NGOs and other citizen movements to act against the realisation of an option
- ☐ SOC: Mortality due to normal operation
- ☐ SOC: Expected mortality due to severe accidents
- ☐ SOC: Subjective health fears due to normal operation
- ☐ SOC: Potential for a successful attack
- ☐ SOC: Potential for misuse of technologies and substances within the nuclear energy chain
- ☐ SOC: Work qualifications: total years education for workforce
- ☐ SOC: Extent to which residents feel highly affected by noise
- ☐ ENV: Total consumption of uranium
- ☐ ENV: Global warming potential
- ☐ ENV: Impacts of toxic substances on ecosystems
- ☐ ENV: Large release of hydrocarbons
- ☐ ENV: Total weight of special chemical wastes stored in underground repositories
- ☐ ECO: Average generation cost
- ☐ ECO: Medium to long-term independence from foreign energy sources
- ☐ ECO: Ratio of the fuel cost to the generation cost
- ☐ ECO: Total average variable cost or "dispatch cost"
- ☐ ECO: Equivalent availability factor
- ☐ SOC: Probability that waste storage infrastructure will not be available
- ☐ SOC: Potential of energy system induced conflicts
- ☐ SOC: Necessity of participative decision-making processes for different technologies
- ☐ SOC: Morbidity due to normal operation
- ☐ SOC: Maximum credible number of fatalities per accident
- ☐ SOC: Psychometric variables: personal control, catastrophic potential, perceived equity familiarity
- ☐ SOC: Maximum credible effect of a successful attack
- ☐ SOC: Share of the effective electricity costs in the budget of a social welfare recipient
- ☐ SOC: Functional and aesthetic impact of energy infrastructure on landscape
- ☐ SOC: Total traffic load

51. **Are there any important indicators missing? If you think so, which would you add to the list of indicators?**
You can also specify the sustainability dimension to which you would assign a specific indicator, and you can explain why a specific indicator should be considered

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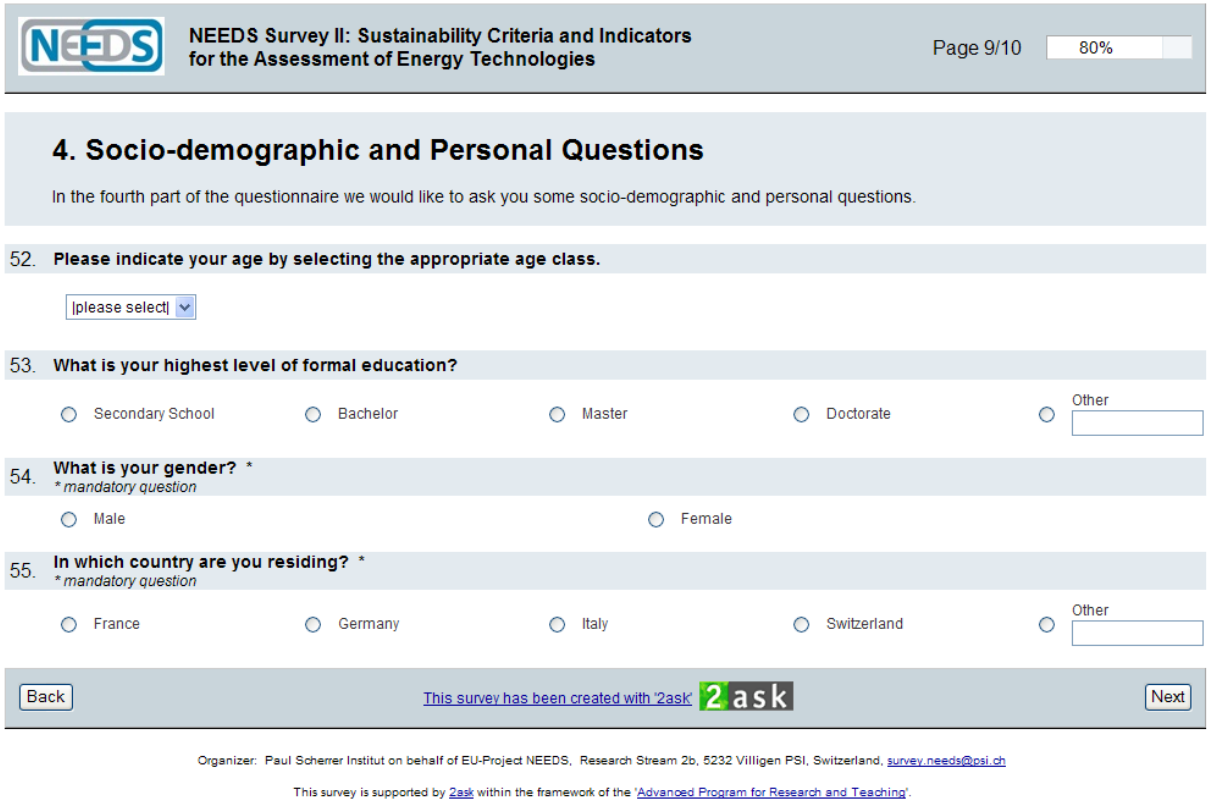

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4. Socio-demographic and Personal Questions

In the fourth part of the questionnaire we would like to ask you some socio-demographic and personal questions.

52. **Please indicate your age by selecting the appropriate age class.**

|please select|

53. **What is your highest level of formal education?**

Secondary School | Bachelor | Master | Doctorate | Other

54. **What is your gender?** *
** mandatory question*

Male | Female

55. **In which country are you residing?** *
** mandatory question*

France | Germany | Italy | Switzerland | Other

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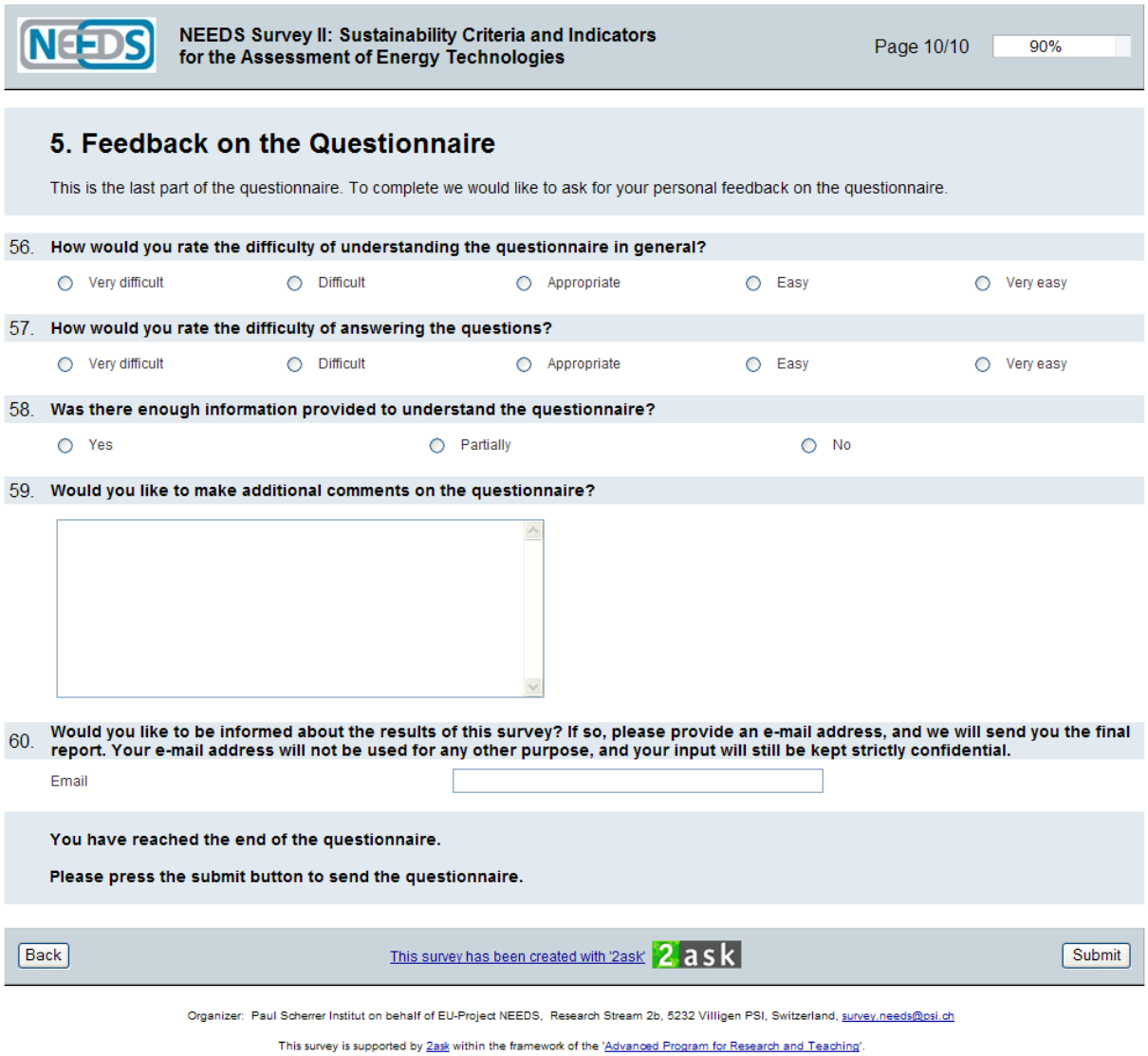

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5. Feedback on the Questionnaire

This is the last part of the questionnaire. To complete we would like to ask for your personal feedback on the questionnaire.

56. **How would you rate the difficulty of understanding the questionnaire in general?**

○ Very difficult ○ Difficult ○ Appropriate ○ Easy ○ Very easy

57. **How would you rate the difficulty of answering the questions?**

○ Very difficult ○ Difficult ○ Appropriate ○ Easy ○ Very easy

58. **Was there enough information provided to understand the questionnaire?**

○ Yes ○ Partially ○ No

59. **Would you like to make additional comments on the questionnaire?**

60. **Would you like to be informed about the results of this survey? If so, please provide an e-mail address, and we will send you the final report. Your e-mail address will not be used for any other purpose, and your input will still be kept strictly confidential.**

Email

You have reached the end of the questionnaire.

Please press the submit button to send the questionnaire.

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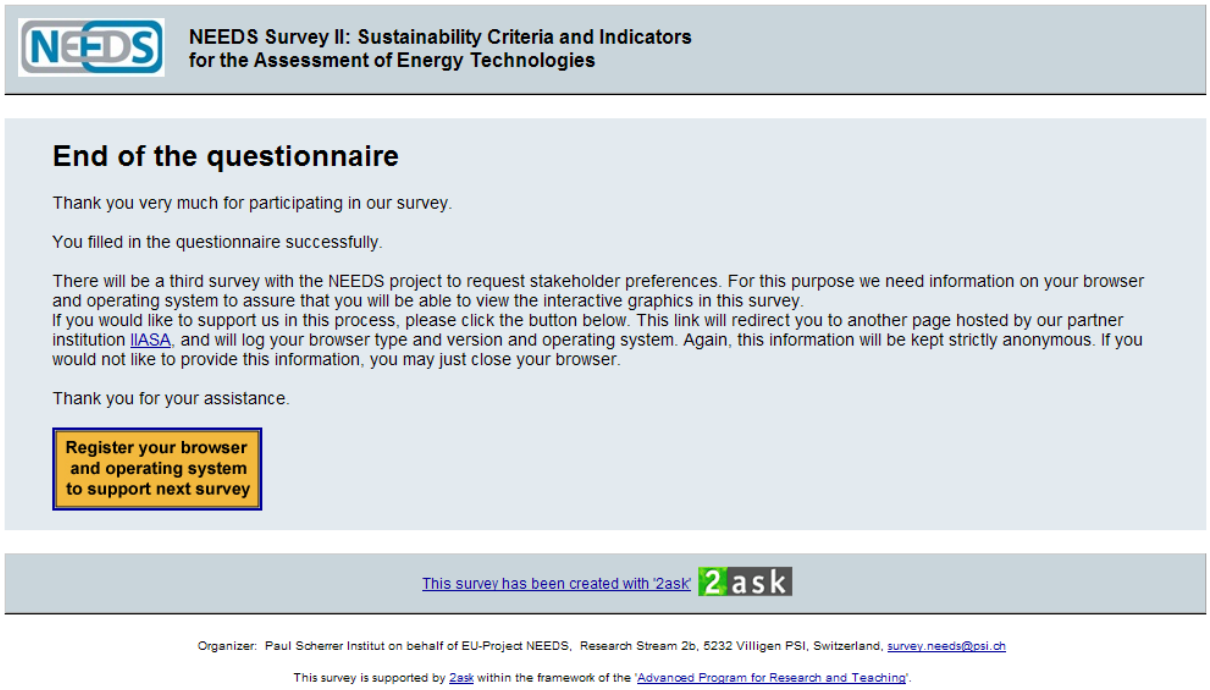

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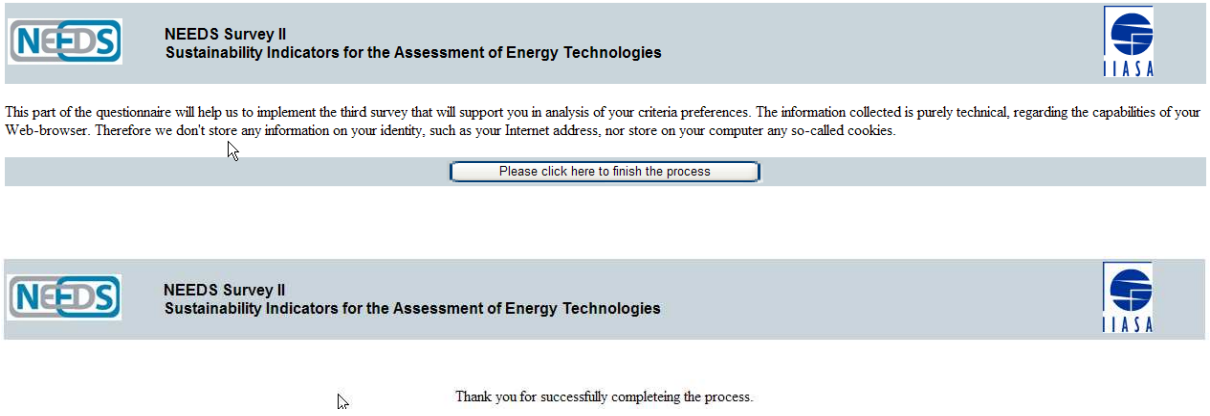

Figure D1 Contents of Survey II questionnaire.

E.) Individual feedback on questionnaire

Table E1 Individual comments, suggestions, and critics etc. of the participants on the questionnaire.

A little bit more information about what is the overall topic, what years are we looking at 10, 50 or 100 years. (it was difficult because many of the questions is difficult in its nature. The expression sustainability is difficult. It is too easy to include everything. And I guess that is why you have this survey...)
a) Es ist schwierig diese Fragen "objektiv" zu beantworten, weil man über die 3 Dimensionen unterschiedlich viel weiß. b) die Einteilung bezgl Relevanz ist mir schwer gefallen. Ich habe gezögert "Sehr wichtig" zu wählen, weil ich dachte, vielleicht kommt ja etwas noch wichtigeres. c) wenn ich Relevanz "sehr gering" gewählt hätte, dann hätte ich wohl sicherlich nicht die Notwendigkeit gesehen es zu behalten. d) aufgrund des Hinweises, dass event nicht alle Indikatoren verwendet werden habe ich viel als "nicht beibehalten" gewählt.
Bei einigen qualitativen Kriterien waren Meßgrößen wie "Ordinalskala" angegeben. Ich halte es für besser, in solchen Fällen Bewertungsbeispiele anzufügen, z.B. unterstützt durch Abbildung von Skalen.
Beim Entwerfen des Fragebogens an den Fragenden denken und weniger an den Wissenschaftler, der ihn auswertet. Einführungstext mit Kurz- und Langfassung wäre besser.
Certaines questions couvrent partiellement un aspect des impacts et on se demande pourquoi. Par exemple on parle des déchets nucléaires de faible et moyenne intensité, mais pas des plus dangereux...
Dans la "pertinence" d'un critère, j'ai pris en compte la difficulté à mesurer l'indicateur, qui rend ce critère peu opérationnel. Ou le caractère redondant. Ou enfin son aspect non discriminant à mon avis (exemple : toutes les filières ont capacité à intégrer de l'innovation). Quant au nombre total, il est un peu trop élevé mais en même temps il vaut mieux intégrer tous les aspects de la question et gérer le nombre par une hiérarchisation marquée des critères, qui va sans doute dépendre beaucoup de l'observateur.
Das ist wohl ein Fehler: Zeile 60 "..... Ihre E-Mail Adresse wird nicht ausschließlich zu diesem Zweck genutzt....."
Der Fragebogen ist einseitig zu Gunsten der erneuerbaren Energien ausgerichtet. Selbst Fusionsenergie würde bei diesen Kriterien sehr schlecht bewertet werden. Außerdem werden Kriterien mit geringen Differenzierungen mehrfach vorgeschlagen. Fazit: Systematik gut, Inhalt offensichtlich subjektiv geprägt.
Die 40 Indikatoren sind eine zu grosse Menge an Indikatoren, um einen klaren Überblick zu behalten ... und damit auch um die Fragen wirklich sinnvoll und kongruent zu beantworten.
Die Auswahl der Indikatoren sagt nichnicht süber die Bewertung und Gewichtung. Die ist aber entscheidend angesichts der fatalen Enegiepolitik der EU (Biokraftstoffquote, Atomenergieförderung, Förderung Wasserstoffwirtschaft).
Die Fragen wurden sehr kompliziert gestellt. Wahrscheinlich muss man studiert sein um diesen Fragebogen ev. richtig zu verstehen.
Die Indikatoren müssen auch von "normalen Leuten" verstanden werden, oder?
Die unten stehende Formulierung " Ihre E-Mail Adresse wird nicht ausschließlich zu diesem Zweck genutzt ... ist fragwürdig, wenn Sie nicht gleichzeitig angeben zu welchen anderen Zwecken die Emailadresse verwendet werden soll.
Die Vielfalt der vorgeschlagenen "SOZ" Indikatoren ist am Rande der Verwirrlichkeit. Es ist nicht nachvollziehbar, wie ausgereift die Methoden zur Erfassung dieser Indikatoren sind (strukturierte Expertenbefragungsmethoden usw.)
Difficult to respond without some good examples of how the results would be used

easy for me, probably very difficult for policy makers
Einzelne Fragen sind nicht genügend klar formuliert resp. voneinander abgegrenzt: -- Fragen 30 und 31 sind fast dasselbe, deshalb sollte nur eine davon berücksichtigt werden -- Frage 32 ist nicht relevant für die NH-Beurteilung, da einerseits von 30/31 bereits teilweise mit berücksichtigt, und da anderseits abhängig von nationalen gesetzlichen Regeln (welche aber deshalb nicht mehr oder weniger nachhaltig sind) -- Frage 40 könnte in 38 integriert sein, da es für die Opfer ja keinen grossen Unterschied macht, warum der Störfall eintritt. (NEEDS muss nicht in den Terror-Hype eintreten...). Dies könnte geschehen, indem nicht "Unfälle" sondern jegliche "Störfälle" betrachtet werden. Ob dieser von einem technischen Defekt oder von Terroristen ausgelöst wird ist sekundär. -- Frage 42 dürfte nur berücksichtigt werden, wenn die wirklichen Stromkosten (nicht der Strompreis!) beurteilt würden, denn bei steigendem Strompreis werden sich stromsparende Technologien stärker durchsetzen, so dass ein höherer Strompreis nicht notwendigermassen und in keinem Fall linear höhere Stromkosten bedeutet. -- Bei Frage 44 ist nicht klar, ob nur die Stromerzeugungsanlage (wie in der Frage) oder die gesamte Herstellungskette (wie im Kommentar zur Frage) beurteilt wird.
Expéreience intéressante. Meme si on peut en discuter, ce questionnaire est le fruit d'un travail important et susicte des questions pertinentes.
Fragebogen viel zu umfangreich und detailiert, mit Verliechsfragen wäre Beantwortung einfacher
Fragebogen viel zu umfangreich, viel zu viel Text. Wer hat heutzutage schon Lust und nimmt sich die Zeit, mehr als 30 Minuten an einem Fragebogen zu lesen und zu beantworten! Selbst ich als Energiespezialist fand das Ausfüllen des Fragebogen sehr monoton und mühsam. Habe daher de letzten Fragen, die mich nochmals in einen Loop ums selbe Thema drücken wollten, nicht mehr beantwortet.
Für die Angabe der 5 wichtigsten und 5 unwichtigsten Indikatoren hätte ich mir gewünscht, die Indikatorendefinition nochmals anschauen zu können.
gewisse Fragen sind relevant, nur der Indikator nicht notwendig, dh nicht geeignet. Zb bei dem Sozialhilfeempfänger kann ich mir vorstellen, dass da unterschiedliche Standards herrschen, die das Bild verzerrt. Oder der Einbzug von Stakeholdern bei der Planung wird von Staat zu Staat unterschiedlich gehandhabt, was ein vergleich wohl schwierig macht. Die Beantwortung der Fragen is allgemein angemessen, teilweise schwierig
Give more examples of what each question means in terms that an average person understands. Even give some expected answers, with the reasons behind the choice.
Gradirei avere la possibilità di pubblicare l'esito del questionario sulla newsletter www.lascossa.org
Grundsätzlich erscheint als Schwachstelle, dass viele der genannten "Indikatoren" auf Experteneinschätzungen beruhen. Damit bleiben "weiche" Fragen "weich" und der Indikator kann nur eine Pseudo-Objektivierung bieten. Bei Risikofragen "objektiver" Natur (Anschlagsrisiken, Schadenspotenziale, Risiken politischer Konflikte und Abhängigkeiten) sind mit etwas methodischem Aufwand auch gesichertere Quantifizierungen möglich. Allerdings reicht die gewöhnliche Wahrscheinlichkeitstheorie hier nciht aus, da man es häufig mit "Damokles"-, "Kassandra-" und "Pandora"-Risiken zu tun hat.
Hi Peter - WWS
Ho partecipato direttamente alla costruzione del questionario per il Delphi di Eurendel. Questo mi sembra più agile
I would have liked to see the consequences of my ranking. This is a clear lack of this questionnaire. Furthermore I would have appreciated to comment on the subgrouping of any items, which was not possible. I ask the person preparing the evaluation of all answers to delete my Email address before passing it to the NEEDS researchers.
Ich finde die Art der Fragestellung für einen Fragebogen schwierig. Bei behalten / nicht behalten weiss

man nicht welche oder vieviele Kriterien noch kommen. Dies erschwert diese Antwort.
Ich frage mich, ob das ein Nutzen bringt. Als Standortbestimmung vielleicht, aber wenn es als JeKaMi in der Forschung verwendet werden soll, dann gute Nacht. Die Information der Entscheidungsträger (d.i. die Bevölkerung) muss am Anfang stehen, nicht die vielleicht unrealistischen Vorstellungen der Entscheidungsträger.
Ich habe beim Ausfüllen von Frage 9 versehentlich eine Umteilung in eine andere Kategorie angeklickt. Dies konnte ich nicht mehr rückgängig machen. Es wäre wünschenswert, wenn zu den einzelnen Fragen Bemerkungen gemacht werden könnten. Zudem hätte ich gerne meine Antworten irgendwo in elektronischer Form für mich speichern wollen.
Il est très diffile de répondre à ce questionnaire, car le domaine est très flou, et les questions trop vagues. A-t-on aujourd'hu des éléments pour prévoir une attaque surprise ? comment évaluer le nombre d emorts potentiels ? Donc, quel est le sens réel de ces questionnements ? Connait-on aujourd'hui la mortalité liée à une filière ? non, donc quel est le sens réel de ces questionnements ? Consommation de ressources : en cas de peak oil, ne va-t-il pas y avoir progressivement adaptation des économies ? dans le cas contraire, les indicateurs restent-ils valables en cas de révolution mondiale (ou européenne ?) quel est le sens réel de ces questionnements ? Quelle est la validité des indicateurs proposés ? on sait qu'il y a débat autour du traitement de la toxicicolgie dans une approche ACV. quel est le sens réel de ces questionnements ? etc. Le questionnaire est long ; mais il mélange trop de problématiques différentes pour être crédible. Je ne peux cacher mon scepticisme devant la démarche ; veuillez considérer mes remarques comme des remarques constructives. Bon courage pour la suite.
Im Gegensatz zu Ihren Angaben unter Ziff. 60 will ich, dass meine Email-Angabe ausschliesslich «zu diesem Zweck» genutzt wird.
It is not clear reason of question 24 because question 18 includes operation and maintenance cost
It seems to focus on the technology choice of the past, e.g. coal vs. nuclear.
it would have been useful to give examples for the criteria to illustrate what is meant exactly (esp. the different private cost categories). i would have preferred one economic criterion : the total private + external costs of a technology,.
J'ai des doutes sur la possibilité d'interprêter correctement le résultat. En fait, il aurait fallu un exposé méthodologique d'une dizaine de pages pour qu'on comprenne comment seront interpétés les réponses, puis un questionnaire plus court. Ou alors regrouper les critères par groupe de 3 ou 4, avec une explication.
Je n'ai pas pu modifier certaines de mes réponses: par exemple, si je coche un réponse par erreur alors que je désirais NE PAS RÉPONDRE à cette question, je ne peux pas le faire.
Le domande senza risposta sono quelle che non avuto tempo di approfondire. Purtroppo la mancanza di tempo non e` un fattore secondario. Capisco che il questionario sia di livello avanzato, per 'specialisti' ma mi chiedo come possa essere compreso da chiunque altro. Mi spiego: non sono parametri comprensibili in un quotidiano. Non sono parametri che un politico o un giornalista possa utilizzare con cognizione di causa. Chiaramente serviranno per altre persone, ma quando queste interagiranno con il politico che succedera'?
Man sollte auf speziefische Energie-Wirtschaftsbegriffe wie zB. "Kapatitätseinlastungskosten" oder "Dispatch" verzichten resp. diese so elegant erklären, dass die Indikatoren auch für "Branchenfremde" nicht abstossend oder zu schwierig wirken.
meno tempo per la compilazione
Not sure what your target audience is, but for an average EU citizenthis is way too complicated.
Prinzipiell ist er in Ordnung. Man hätte noch eine Kategorie einfügen können: Abwandlung bzw. Bemerkung, da es zu nahezu jedem der Indikatoren Alternativen gäbe, die durch leichte

Umformulierungen der Indikatoren erzeugt wuerden.
q6001
Schwierigkeit: Nach einmaligem Auswählen des Radiobuttons zum Verschieben eines Indikators in eine andere Nachhaltigkeitskategorie kann die Auswahl nicht mehr entfernt werden.
Si potrebbe aggiungere per una migliore comprensione una indicazione su chi userà questi indicatori di sostenibilità e a che scopo. Potrebbero essere inoltre utili questioni mirate anche su specifiche fonti di energia.
some aggregation of criteria
The indicators I suggested not to be included are partially covered by others (e.g., #30. "Potential of conflicts induced by energy systems" partially covers the aspects of #31. "Willingness to act (mobilization potential)" and #32. "Necessity of participative decision-making processes"; and #18. "Price of electricity", although definitely important, is somewhat covered by 42. "Socially compatible development / Equitable life conditions", Indicator: "Share of the effective electricity costs in the budget of a social welfare recipient [%]"). For me, it was difficult to judge how one would possibly quantify many of the social indicators. At times it was stated that expert judgement is used. I had the impression that this would be the case for others as well without making this explicit. But this is a mere guess of mine.
The list is quite long and considering other pressing reduces the chances that all answers are provided. I stopped somewhere.
The questionnaire itself is fine; comments can be made on the scope and consistency of the project that brings it up.
the third level choice can not be undone, inconvenient if someone wants to revise her/his original choice
The total consumption of fuel cannot be measured in MJ/kWh in a comparative analysis. This parameter should be related to the availability of the fuel in the long term. The land contamination cannot be measured in sqkm/kWh. There, a quantification of what contamination means is missing. If we e.g. put the value down to a couple of Bq / sqm, the whole world would be contaminated. For comparison: hydrocarbon contamination is measured in t/kWh, which is at least somewhat closer to their potential impact. Why the chemical waste is measured in kg/kWh and the nuclear in m³/kWh? Employment: I would not put emphasis on employment factors at the begin of the industrial "nutrition chain". Energy has to be cheap, what probably means that it has to be produced with as less as possible labour, in order to "create" labour in the rest of the system. For the same reason I excluded factors 24-26. The total costs are deciding. Questions 27, 28: Politicians learn from reality, not vice versa, even if this is a long, painful and often bizzar process. Question 31: the above comment holds equally for the public, too. 41: Proliferation is not a criterion, it must be solved by safequards. The same what we do in politics ("war is continuation of politics with other means"). We prepare ourselves to attacs from hostile neighbours by developing the ability to defent ourselves (army). For this, we accept victims, economical efforts and we develop a lot of best technology. Why we surrender immediately, when we belief that terrorists might steal fissile material or attack nuclear infrastructures, which very probably might turn soon out to be of vital interest for the society is highly incomprehensible. 48: This question comes too early. Afterwards there are still some nasty questions ;-)
The ways in which certain indicators are determined seem complicated (e.g. "expert opinion") and therefore the validity and importance of these indicators is hard to evaluate. A more practical note: if one changes the dimension of a certain indicator (e.g. from "environmental" to "social"), either deliberately or by accident, it is impossible to correct this change later on!
There are too many not necessary indicators
Too many social indicators It would be a nice feature if one could download one's own filled in questionnaire (e.g. as pdf-file) in the end.
Umweltdimension: Bereichsgliederung logisch nicht konsequent: Klimawandel und Abfälle sind

Sonderformen von "Einfluss auf das Ökosystem". Durch die Ausgliederung von Themen aus ihrer logischen Position wird ihre hervorgehobene Bedeutung präjudiziert. Die Frage, ob ein Indikator beibehalten werden soll, kann eigentlich nur im Bezug auf eine Indikatorengesamtzahl beantwortet werden. Ich habe daher die Frage nicht beantwortet, wenn die Aufnahme in einem knappen Katalog entbehrlich, in einem ausführlichen Katalog jedoch empfehlenswert wäre. Fossile Ressourcen + Uran könnte zu "nicht erneuerbare Ressourcen" zusammengefasst werden 11. Erklärung unklar: x wird durch y und z multipliziert??? 12. Ebenso unklar. Und warum kommt in der Erklärung nochmal Landschaftsverbrauch? 13. dto. Technischer Hinweis: Man kann ein Votum zur Notwendigkeit, wenn einmal erteilt, nicht mehr zurücknehmen, sondern nur noch ändern. D.h. man kann das Feld nur unausgefüllt lassen, wenn man es noch nicht verwendet hat. Eine Liste der begutachteten Technologien wäre hilfreich gewesen, um die Relevanz mancher Indikatoren beurteilen zu können. Auch der Zeithorizont ist dem Befragten nicht bekannt, kann aber Einfluss auf die Relevanz mancher Indikatoren haben. 21. Erklärung erschließt den Indikatortitel nur unvollständig: Viel wichtiger ist doch die Gefährdung des Investivkapitals durch Änderung der Rahmenbedingungen während der Betriebszeit. ... Ich stelle die individuelle Kommentierung ab diesem Punkt aus Aufwandsgründen ein. Die Erklärungen passen in einigen Fällen nicht zum Indikator. In manchen Fällen wäre außerdem meine Empfehlung nicht "beibehalten" oder "nicht beibehalten", sondern "zusammenfassen" gewesen.
Una idea da sviluppare potrebbe essere l'interrelazione (sinergia ?) tra i vari indicatori.
Vielleicht später einmal (derzeit zuviel andere Anfragen vorlilegend...)
Voir formulaires/ questionnaire précédent. Beaucoup de questions nécessitent la connaissance de la valeur de critéres. Il est possible de répondre à ce questionnaires de manières différenciée si on veut favoriser une technolgie plutot qu'une autre. Ceratines questions sont trop orientées => on comprend rapidement pour quelle technologie l'indicateur est proposé.
zu lang
Zu viele soziale Indikatoren. Beschränkung auf 3 - 4 relevante Indikatoren pro Bereich. Indikatoren sind z.T. nicht unabhängig voneinander. "Ihre E-Mail Adresse wird *nicht* ausschließlich zu diesem Zweck genutzt ..." Bitte E-Mail Adresse ausschliesslich für Zustellung des Abschlussberichts verwenden und keinesfalls weitergeben!