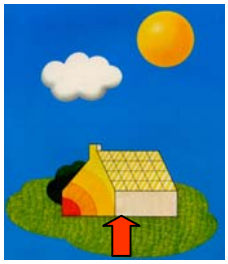
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Task 44

Solar and heat pump systems

Systems using solar thermal energy
in combination with heat pumps



Annex Plan

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1. Description of technical sector

In the last years an increasing number of systems for house heating and/or domestic hot water production has been developed which use a combination of solar thermal systems and heat pumps. Active promotion of ground coupled heat pumps and efficient modern air heat pumps have led to a growing market penetration of electrical heat pumps.
The market is driven by ecological consideration as well as in some regions by obligation of using solar for preheating of domestic hot water.

The heat pump industry on one hand and the solar industry on the other hand have been presenting at major trade fairs first commercial systems of a combination of solar and heat pump solution. Some manufactures of both world have started tigth collaboration around a common combined system.
Claims of reaching 100% renewable in such combination are made, although there is of course still some electrictiy needed which has a primary source not necessarily renewable.

In this new market segment most manufacturers exhibit a background in one of the two main involved technologies. However this does not guarantee that the combination leads to an optimal system for the following observations can be made:

- Main system components are just placed one beside the other and do not always interact in phase. Solar energy is mainly used to reduce the electricity demand for hot water preparation and thus heat pump manufacturers tend to put systems side by side with no interaction. Is it the optimum ?

- In other systems, the main purpose of the heat pump is understood as a method to increase the energy gain of the solar collector system. The heat pump allows to use solar energy even if the temperature of the gained heat has a temperature level below the required temperature of the demand side (heating system, hot water). This was already on the market 30 years ago with the solar roof concept with various unglazed collector types. It is now regaining some attention from the market in situation where ground or air heat source might not be optimal sources.

- We see developments of overall system concepts where solar heat is used as the main source for a heat pump either directly or indirectly, i.e. where the two producers are uncoupled through one rather large heat storage. The storage may be sensible or latent (PCM, ice) and a short term or a long term type (e.g. ground). How big should that storage be ? Where shoult it be placed into the system ? Is it worth increasing the interaction of the solar and heat pump ?

Although recent publications are dealing with some coupling of the two technologies, no systematic analysis of the different systems and their application potentials in different sectors and under different boundary conditions has been undertaken around the world. This was clearly a statement of the international experts during the preparatory meetings of this Task in the course of 2009.

Moreover standards sometimes precede the boom of a technology and keep it into quality frameworks that the market need. The systems we are discussing and the way to test and

qualify them are not yet described in norms or standards opening the door to non scientifical commercial claims and future desillusions.

Four main components will interact in a combined solar and heat pump system:

- the solar collectors which can be of any type glazed, evacuated or unglazed.
- The heat pump which can be air source, water source or ground source type.
- A storage which can be a water tank, a PCM tank, the structure of the building or the ground, or any other future new type.
- The control strategy which determines how the other components interact.

The increasing number of offered systems using a combination of these three components and the high expectations about their contribution to energy efficient heating, hot water (and possibly cooling) of buildings give background to our proposed systematic investigations.

A systemic comparison of existing systems is needed both from an economical and environmental point of view. In addition, it might be highly advisable to adjust various systems to their specific boundary conditions, such as buildings standards or climate zones.

We know from the past IEA Tasks, that the best approach is a systematic approach, including the modeling, simulations and field-testing of the joint use of solar thermal energy and heat pumps. This method allows optimization and further development of the relevant systems as did Task 14 and Task 26 prove it.

After all only a high quality of systems on the market will ensure a sustainable development of this type of combinations of solar and heat pumps. The high quality means competition and comparison. Competition is present in both sectors solar and heat pumps. Fair and independent comparison makes it necessary to have a common agreed approach for system characterization, performance definition, benchmarking reports and standard compliance. If not we will see installations with poor results and unsatisfied users that will affect the “new” market for combined systems (solar thermal + heat pumps) but also the more established markets for heat pumps and solar thermal.

The Task will emphasise system description and reporting, system monitoring, and performance assessment methods to enable comparison of various systems on few criteria. The emphasis will be on market technology, but new developments during the Task will be incorporated as much as possible since the market evolves rapidly. The selection of systems to be investigated will be according to available cases and resources and as much as possible with industrial collaboration in the Task.

Participants into this Task will include scientists, HVAC engineers, solar and storage components manufacturers, heat pump manufacturer, complete heating solutions providers and industry representatives. Coordination with other Tasks of the IEA Solar Heating and Cooling Programme, IEA Building and Community Systems and IEA Energy Storage as well as the Heat Pump Programme of the Heat Pump IEA Annex will take place as appropriate.

2. Objectives and scope

The objective of this Task is the assessment of performances and relevance of combined systems using solar thermal and heat pumps, to provide common definition of performances of such systems .....and to contribute to successful market penetration of these new systems.

Other objectives are needed to reach the main one where international collaboration is definitively needed to make it possible within a 4 years framework, mainly:

- Surveying the possible generic combinations
- Defining performance figures of a combined solar and heat pump solution
- Defining assessment and test methods of such systems
- Analysing monitored data on such systems
- Developping component models or integrating existing ones into a system model
- Simulating various systems under common conditions
- Providing guidelines of good practice to the market and stakeholder
- Providing authorities with relevant information on the interest of such systems.
- Staying close to the market and bringing independent information and kwoeldege to the actors on this market along the duration of the Task.

The scope of the Task considers solar thermal systems in combination with heat pumps, applied for the supply of domestic hot water and heating in family houses.

The Task covers small-scale systems for providing heating and domestic hot water, possibly cooling, to houses using solar thermal collectors and heat pumps as core components. The focus of the Task activities is on systems which are offered as a combination i.e. one product from a system supplier or manufacturer and are installed as such by an installer. Systems dealt with can also be applied to dwellings.

Large scale systems are considered but not as the main focus. They will be looked at as field cases to provide ore experience and insight on solar and heat pump combinations.

Any type of solar collector is possible: using a liquid heat tranfer fluid, air, hybrid collectors, or PVT-collectors. All of them can be glazed or unglazed.
Any type of source of heat for the heat pump can be considered: air source, water source or ground source. The main focus will be on heat pumps driven by electricity as the market is so oriented. However during the course of the Task it might be become relevant to consider thermally driven heat pumps.

To limit the scope, comfort cooling of buildings is not direclty addressed in the Task common work, although it is not forbidden for a heat pump to be used for cooling purposes besides its main heating objective, for example in reverse mode.

The Task covers market available solutions as well as advanced solutions, which may be still in a laboratory stage or still will be developed during the course of the Task.

Competing solutions on the Task market segment i.e. “one family house” system will come not only from classical fuel industry but also from the photovoltaic sector. A compressor heat pump driven by electricity produced by solar PV can be a 100% renewable solution.
Those systems are thus out of the scope of this Task if they have no solar thermal collectors installed.
As far as grid load is concerned, performance figures like a “load management factor” can include grid load issues, such as load profile, peak power demand and moment in the year of this peak for combined solar and heat pump solutions.

Performance figures will adress energy and cost.

3. Means

The Participants shall share the coordinated work necessary to carry out this Task.

(a) The objectives shall be achieved by the participants in the following Subtasks:

Subtask A:	Solutions and generic systems	(leader: Germany, Fraunhofer ISE)
Subtask B:	Performance assessment	(leader : Austria, AIT)
Subtask C:	Modeling and simulation	(leader: Sweden, SERC)
Subtask D:	Disseminaton and market support	(leader: Italy, EURAC)

(1) Subtask A: Solutions and generic systems

The objective of Subtask A is to collect, create and disseminate information about the current and future solutions for combining solar thermal and heat pump to meet heat requirements of a one family house.

All systems on the market as well as future systems can be described in terms of arrangement of the components i.e. serie or parallel, on the evaporator side or on the load side, etc…
Subtask A will have to review a number of existing systems and to generate a number of conceptual designs of future systems in order to establish a list of generic systems in which any system can be classified.

The contents of subtask A is about:
- Hydraulic schemes, Typologies of systems, System classification
- Control strategies
- Presentation of systems: description, examples
- Survey on new solutions and concepts
- New heat pumps adapted to solar

- New solar collectors adapted to heat pump systems
- Request for new storage types
- Experiences and needs for modificiation of components
- Nomenclature, symbols

The deliverables of Substak A will be:

- Technical brochures on system solutions with a common reporting format
- Technical reports on in situ monitored systems
- A report on large scale systems if cases have been presented by participants
- A map of generic (small scale) systems with pros and cons, usefull for potential buyers of solar+heat pump
- A contribution to the common final book on systems using solar thermal energyand heat pumps (see description in Subtaks D)

The main activities in Subtask A are:

A1: Review of existing systems and new system configurations

A reporting format will be generated and existing system solutions provided by participants will be reported and analysed with this format.
New system designs will be generated or followed during the course of the Task and reported.

A2 Reporting field test results

Participants will bring the results of monitored systems to be shared. Those results will be reported with a common format in order to be comparable and analysed. The data can also be used as a basis for validation work in subtask C.

A3 Large scale systems case studies

Participants willing to share experience on large scale systems will bring their views on either design concepts or real projects dealing with large area of solar collectors and large power heat pump solutions. Since not many participants might have cases to report, this activity will be run depending on the participation. It might be lead and reported, not by subtask leader, but by the most interested country in the field, if the interest is not shared enough during the Task period.

A4 Dissemination and information

- The subtask will issue reports on each monitored systems and technical papers, that will be available on the Task web site.
- The subtask will issue a map of generic systems.
- Participants will take part of scientifical and industrial conferences.
- Subtask participants will write chapters of the final common book

A5 Subtask report

The subtask will issue a final report summarizing and referencing the work done.

A list of several market available systems and several systems monitored or being monitored in different countries that can be used in Subtask A is already available at the beginning of the Task.

(2) Subtask B: Performance assessment

The objective of this subtask is to reach a common definition on what are the figures of merits of solar + heat pump systems and how to assess them.
This work can lead to prenormative definition on how to test and report the performance of a combined solar and heat pump system.
The output of this Task should ideally be used by the industry to communicate the performances of the system they promote, like in the solar collector market collectors are reported with their efficiency curve which makes them comparable with others at least on one important criteria which is the energy performance.

The topics of Subtask B will include:

- Testing on test stands
- Definition of terms, system boundary and reference systems
- Development of test standards
- Labelling
- Laboratory testing of components and global systems
- Experiences and learnings; feedback on components
- Commissioning issues
- Performance indicators: energy, economy, environmental outputs.

The deliverables of Subtask B will be:

- Definition of performance indicators
- Technical reports and scientifical articles
- System and component measurement procedures and techniques for relevance
- Laboratory testing sequence and procedure for assessing the system quality
- Proposal for standard/s (CEN or others)
- Proposals for labels (background for a future Solar and heat pump “keymark”).

The main activities in Subtask B are:

B1 Definition of performance indicators

A review of the state-of-the-art of how several authors and experts define a system performance indicator will be done. The work is about combining the solar fraction or solar savings fraction with a COP (coefficient of performance used in the heat pump world or annual SPF (seasonal performance factor) definition, that captures all the aspects of the combination and reports the physics and economics of a combined system.
The performance can be stated at nominal conditions (COP of the heat pump for instance) or integrated over one year (SPF). Both values are of importance.

Proposals of various definitions will be made, tested on known systems and discussed with heat pump experts. If a calculation method for e.g. SPF involves numerical simulation, a close collaboration with Subtask C will ensure the usage of verified, state-of-the-art models and simulation techniques.

A common definition will be decided upon and the other subtasks will use it thus providing a good test platform.

B2 Laboratory testing

Subtask B participants will mainly come from laboratories. They will test in lab different system configurations and/or components depending on their own collaboration with industry. If possible, test procedures developed in B3 will be used. Some non disclosure aspects can be treated if needed. Test results will be discussed so as to get to a good understanding of all system configurations and to be able to propose new ones. Combined systems with water based heat pumps are easier to test but combined systems with air based heat pump have to be considered due to increasing market share.

B3 Standardisation and test definition

Participants will develop a common framework and a testing procedure of system using both solar and heat pump.
There is a lot of generic systems and it will be a challenge to find out and reach one or few testing sequences that are enough to characterize the performance of a system. This has been well done in Task 26 for solar combisystems.
Industry and industry representatives or associations will be included in this activity as much as possible.
Contacts with ISO and CEN will be established. A basis for a labelling scheme will be developed using existing knowledge from relevant quality labels for solar and heat pump systems. The scheme should also take into account technical documentation and commissioning issues.

B4 Dissemination and information

- The subtask will issue reports on tested systems and technical papers, that will be available on the Task web site.
- The subtask will issue a testing procedure for system using solar + heat pump
- The subtask might issue a label for quality solar + heat pump systems.
- Participants will take part of scientifical and industrial conferences.
- Subtask participants will write chapters of the final common book

B5 Subtask report

The subtask will issue a final report summarizing and referencing the work done.

(3) Subtask C: Modelling and simulation

The objective of this subtask is to provide modelling tools for complete generic systems and to report sensitivity analysis on most of the systems such as being able to pinpoint important features and marginal ones in a given system configuration.
Sizing of systems will also be possible using the output of this Subtask, either with the computing tools developed or with general or system specific tables.

The topics of Subtask C will include:

- Thermodynamic analysis of a combined system with 2 heat sources
- Common framework, set of references
- Models for components
- System model using state of the art simulation models
- Validation of models
- Parameter studies; sensitivity analysis; comparison of systems
- Recommendations for dimensioning systems
- Design tool

The deliverables of Subtask B will be:
- New models for components
- New system models
- Technical report on system simulations and validation
- Technical report on system dimensioning
- Design tool

The main activities in Subtask C are:

C1 Reference framework

Subtask C will define a common reference framework for simulation of systems. Similar developments have been made in several SHC Tasks and will be used as a basis. Not to reinvent the wheel. Discussions with Heat Pump Performance experts will be a plus. Reference conditions will be platform independant. A reference system will be defined so as to be able to do system comparisons in subtasks A, B or C. Experience from IEA SHC previous tasks and IEA HPP Annexes will be used for defining the reference conditions and system.

C2 Model of subcomponents and validation

Subtask C will have to work on sub component models when not available, or integrate disseminated models. A survey of model requirements and model availability will be made at the start and used as basis for further development within the Task.

Validation will be done as far as possible, against other models, against laboratory testing or against field testing. Control and operational strategies important parts of this work. . Close collaboration with Subtasks A and B will take place.

C3 System simulation and validation

Subtask C will integrate component models into system models. Platforms such as Trnsys, Modellica or Polysun could be used. All systems presented within Task 44 that are relevant to be simulated should be simulated and optimal combinations and/or optimal operational strategies should be found. This is a great way to learn how to do better !

Validation will be done again as far as possible, against laboratory testing or field testing provided by the other subtasks. Close collaboration with Subtasks A and B will take place.

C4 System Inter-comparison

The systems analysed within the Task will be compared with the reference system(s) and with one another in terms of general features and performance indicators based on field and lab tests as well as system simulations. Experts from all Subtasks will work on this inter-comparison.

C5 Dissemination and information

- The subtask will issue reports on models and technical papers, that will be available on the Task web site.
- The subtask will issue several models for various systems using solar + heat pump
- Participants will take part of scientifical and industrial conferences.
- Subtask participants will write chapters of the final common book
- A design tool for combined solar and heat pump for planers would be desirable. This tool if appearing should be a commercial product to be durable. Contacts with software producers will be taken early in the activity to motivate them to use our Task results.

C6 Subtask report

The subtask will issue a final report summarizing and referencing the work done.

(4) Subtask D: Dissemination and market support

The objective of this subtask is to provide information to the external world of Task 44 during the course of the Task so that value added created by the participants can be transferred as fast as possible to a growing market. A second objective is to deliver the final book of Task 44 aimed as a reference document in the field of solar heat and heat pumps.

The topics of Subtask C will include all the work of the other subtasks.

The deliverables of Subtask D will be:

- Guidelines for planers and other target audiences: installation, commissioning, operation, with do's and don't's
- Assessment of existing norms, regulations and transfer new performance assessment methodologies to the target audiences
- Education schemes
- A dedicated website gathering all the outputs of the other Subtasks
- 1 to 2 newsletters par year
- Participation in workshops and international conferences (Eurosun)
- A final handbook.

The main activities in Subtask D are:

D1 Website including Educational material

Within the first 6 months of the project a website will be elaborated presenting the main information's, activities and partners of the project. There will be included as well an internal working area in order to upload the meetings information's and draft reports. This could be hosted on the iea-shc.org site or on Subtask leader site.

The educational material will be also issued once a year, part of it in the form of a newsletter and his content will be available on the web site. It will be presented in forms of slides usable by anyone.

D2 Newsletter and guidelines for planers

There are planned 6 newsletters over the project period. In the 2 years of the project are foreseen 1 newsletter a year presenting the task, the main informations and the running acitivities. In the 3rd and 4th year two newsletter per year are foreseen including the main results of the single subtasks. A special focus on one subtask for each newsletter is planned.

The guidelines for planners will be part of the newsletter and his content will be rewrapped in the final handbook of the Task. Basic information will come from the other subtasks..

D3 Workshops and conferences

National workshops will be encouraged and supported, eventually in conjunction with Task 44 meetings.
Papers in international conferences both solar (Eurosun, ISES) and heat pump (HPP) will be proposed.
Subtask D will also be in front line for all communication matters on technical results with the solar heat community and the heat pump community.

D4 System intercomparison

Subtask D will contribute to the chapter or report on system intercomparison and to the dissemination of results.

D5 Final Task 44 handbook

The Task will issue at the end a handbook untitled “Solar heat and heat pumps” gathering all information produced during the Task period. Every chapter of this book will be written by dedicated experts from the four subtasks.

A draft table of content is the following:

Solar and heat pump systems

An IEA SHC Task 44 handbook

Subtask A contribution
chapter 2 on system configurations - pros and cons
chapter 3 on field experience and field monitored results

Subtask B contribution
Chapter 1 on system performance definitions
Chapter 4 on test procedures: what to test and how ?
Chapter 5 on test results on system on testing stands

Subtask C contribution
Chapter 6 on modelling systems and components
Chapter 7 on Task 44 reference framework (or in a specific technical report)
Chapter 8 on comparing simulated system configurations with the reference framework
Chapter 9 on simplified design tool (if reached)

Subtask D contribution
Chapter 0 Introduction
Chapter 8 on comparing simulated system configurations
Chapter 10 on recommandations for designing, sizing and planning systems

D6 Subtask report

A final subtask report will summarize all what was achieved in tue Subtask D as a list of publications done that will be available on the Task web site.

4. Results

The products of work performed in this Task are designed for the solar heat industry (manufacturers of components and systems) and the heat pump industry (manufacturers of components, machines and systems), for prescriptors such as architects, engineers and planners, and finally, for the end-users such as owners of buildings that have to choose a heating system either for a new building or a renovated one.
The focus will be one one family houses.

Results of the activity have already been sketched. They will include to summarize:

Subtask A:

1. technical reports on existing and monitored systems
2. technical reports on advanced ideas and systems
3. possible case studies on large scale systems
4. a map of generic systems with pros and cons
5. contributions to the Task 44 final handbook

Subtask B:

1. a new set of performance indicators
2. a procedure to test combined solar and heat pump systems as a prenorm
3. technical reports on systems tested in laboratory with this procedure
4. contributions to the Task 44 final handbook

Subtask C:

1. a new reference framework for simulating solar and heat pumps systems
2. new components models or compiled existing ones
3. decks for simulating important solar and heat pumps combinations if not all
4. sensitivity analysis on major parameters of some combinations
5. a comparison of several solar and heat pump configurations
6. a simplified design tool (if reached)
7. contributions to the Task 44 final handbook

Subtask D:

1. a website with all major reports and papers
2. educational material on the website
3. support to national workshops about the topic “solar and heat pump”
4. international conferences participation
5. newsletters along the Task duration
6. edition and contributions to the Task 44 final handbook.

5. Time schedule

This Task shall enter into force on:

January 1, 2010 and shall remain in force until **October 31, 2013.**

Within the limits of the term of the agreement this Annex may be extended by agreement of two or more participants acting in the Executive Committee and shall thereafter apply only to those participants.

6. Specific Obligations and Responsibilities of the Participants

In addition to the obligations enumerated in Article 7 of this Agreement

(a) Each Participant shall commit himself in actively working in the Task and provide Operating Agent with detailed reports on the results of the work carried out in each Subtask,

(b) Each Participant shall collect, assess and report to the Operating Agent data on solar heat + heat pumps systems

(c) Each Participant shall participate in the editing and reviewing of draft reports of the Task and Subtasks

(d) Each Participant shall participate in the editing and reviewing of the final book of Task 44 "Solar and heat pump systems".

7. Specific Obligations and Responsibilities of the Operating Agent

(a) In addition to the obligations enumerated in Articles 4 and 7 of this Agreement, the Operating Agent shall:

(1) Prepare and distribute the results described above;

(2) Prepare joint assessments of research development and demonstration priorities for system using solar heat and heat pumps;

(3) At the request of the Executive Committee organise workshops, seminars, conferences and other meetings;

(4) Prepare the detailed Programme of Work for the Task in consultation with the Subtask Leaders and the Participants and submit the Programme of Work for approval to the Executive Committee;

(5) Provide, at least semi-annually, periodic reports to the Executive Committee on the progress and the results of the work performed under the Programme of Work;

(6) Provide to the Executive Committee, within six months after completion of all work under the Task, a final management report for its approval and transmittal to the Agency;

(7) In co-ordination with the Participants, use its best efforts to avoid duplication with activities of other related programmes and projects implemented by or under the auspices of the Agency or by other competent bodies;

(8) Provide the Participants with the necessary guidelines for the work they carry out with minimum duplication;

(9) Perform such additional services and actions as may be decided by the Executive Committee, acting by unanimity.

8. Funding

(a) Meetings.
Experts meetings of the Task will be carried out at intervals of approximately 6 months. Subtask leaders may arrange meetings in between or in association with Experts meetings of the Task. Attendance at the Experts meetings of the Task will be mandatory. The cost of organising meetings will be borne by the host country.

(b) Publications.
In addition to the specific obligations, the Operating Agent will produce, promote and distribute the results of the Task. The Participants will support these activities by contributing respective papers and by dissemination activities financed by the individual Participants.

(c) Individual Financial Obligations.
Each country will bear the costs of its own participation in the Task, including reporting and necessary travel costs

(d) Task-Sharing Requirements.
The Participants agree on the following funding commitment: Each Participant (country) will contribute to this Task **a minimum of 0.4 person year per year of the Task**, i.e. a total of more than 4 person year over the period;

Participation in the Task requires participation in at least one of the Subtasks A, B, C.

The Operating Agent will contribute with **a minimum of 0.3 person year per year to the Task.**

Participation may partly involve funding already allocated to a national (or international) activity which is substantially in agreement with the scope of work outlined in this Annex. Aside from providing the resources required for performing the work of the Subtasks in which they are participating, all Participants are required to commit the resources necessary for activities which are specifically collaborative in nature and which would not be part of activities funded by national or international sources. Examples include the preparation for and participation in Task meetings, co-ordination with Subtask Participants, contribution to

the documentation and dissemination work and Task related R&D work which exceeds the R&D work carried out in the framework of the national (or international) activity.

9. Operating agent

The Swiss federal Office of Energy (Switzerland), acting through Jean-Christophe Hadorn, BASE consultants SA, is designated as Operating Agent.

10. Information and intellectual property

(a) Executive Committee's Powers

The publication, distribution, handling, protection and ownership of information and intellectual property arising from this Task shall be determined by the Executive Committee, acting by unanimity, in conformity with the Agreement.

(b) Right to Publish

Subject only to copyright restrictions, the Participants shall have the right to publish all information provided to or arising from this Task, except proprietary information.

(c) Proprietary Information

The Participants and the Operating Agent shall take all necessary measures in accordance with this paragraph, the laws of their respective countries and international law to protect proprietary information provided to or arising from this Task. For the purposes of this Task, proprietary information shall mean information of a confidential nature such as trade secrets and know-how (for example computer programs, design procedures and techniques, chemical composition of materials, or manufacturing methods, processes, or treatments) which is appropriately marked, provided such information:

(1) Is not generally known or publicly available from other sources.
(2) Has not previously been made available by the owner to others without obligation concerning its confidentiality.
(3) Is not already in the possession of the recipient Participant without obligation concerning its confidentiality.

It shall be the responsibility of each Participant supplying proprietary information and of the Operating Agent for appraising proprietary information, to identify the information as such and to ensure that it is appropriately marked.

Arising Information

All information developed in connection with and during activities carried out under this Task (arising information) shall be provided to each Participant by the Operating

Agent, subject only to the need to retain information concerning patentable inventions in confidence until appropriate action can be taken to protect such inventions.

For arising information regarding inventions the following rules shall apply:

(1) Arising information regarding inventions shall be owned in all countries by the inventing Participant. The inventing Participant shall promptly identify and report to the Executive Committee any such information along with an indication whether and in which countries the inventing Participant intends to file patent applications.

(2) Information regarding inventions on which the inventing Participant intends to obtain a patent protection shall not be published or publicly disclosed by the Operating Agent or the other Participants until a patent has been filed, provided, however, that this restriction on publication or disclosure shall not extend beyond twelve months from the date of reporting of the invention. It shall be the responsibility of the inventing Participants to appropriately mark Task reports which disclose inventions that have not been appropriately protected by filing a patent application.

(3) The inventing Participant shall license proprietary information arising from the Task for non-exclusive use to participants in the Task:

(a) On the most favourable terms and conditions for use by the Participants in their own country.

(b) On favourable terms and conditions for the purpose of sub-licensing others for use in their own country.

(c) Subject to sub-paragraph (1) above, to each Participant in the Task for use in all countries, on reasonable terms and conditions.

(d) To the government of any Agency Member country and nationals designated by it, for use in such country in order to meet its energy needs.

Royalties, if any, under licenses pursuant to this paragraph shall be the property of the inventing Participant.

(e) Production of Relevant Information by Governments

The Operating Agent should encourage the governments of all Agency Participating Countries to make available or to identify to the Operating Agent all published or otherwise freely available information known to them that is relevant to the Task.

(f) Production of Available Information by Participants

Each Participant agrees to provide to a Subtask Leader or to the Operating Agent all previously existing information, and information developed independently of the Task, which is needed by a Subtask Leader or by the Operating Agent to carry out its functions under this Task and which is freely at the disposal of the Participant and the transmission of which is not subject to any contractual and/or legal limitations:

(1) If no substantial cost is incurred by the Participant in making such information available, at no charge to the Task.

(2) If substantial costs must be incurred by the Participant to make such information available, at such charges to the Task as shall be agreed between the Operating Agent and the Participant with the approval of the Executive Committee.

(g) Use of Confidential Information

If a Participant has access to confidential information which would be useful to a Subtask Leader or to the Operating Agent in conducting studies, assessments, analyses, or evaluations, such information may be communicated to a Subtask Leader or to the Operating Agent but shall not become part of the reports, handbooks, or other documentation, nor be communicated to the other Participants, except as may be agreed, between the Subtask Leader or the Operating Agent and the Participant.

(h) Reports on Work Performed under the Task

The Operating Agent shall, in accordance with paragraph 7 above, provide reports of all work performed under the Task and the results thereof, including studies, assessments, analyses, evaluations and other documentation, but excluding proprietary information.

(i) Copyright

The Operating Agent may take appropriate measures to protect copyrightable material generated under this Task. Copyrights obtained shall be the property of the IEA for the benefit of the Participants provided, however, that the Participants may reproduce and distribute such material, but if it shall be published with a view to profit, permission should be obtained from the Executive Committee.

(j) Authors

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The Contracting Parties which are Participants in this Task and their delegates are the following:

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Spain
Sweden
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