IAEA AND IEA ROLES IN INTERNATIONAL FUSION ENERGY RESEARCH

by Drs. T. Dolan, IAEA, and K. Nakamura, IEA *)

The International Atomic Energy Agency (IAEA) of the United Nations (Vienna) and the International Energy Agency (IEA) of the Organization of Economic Cooperation and Development (Paris) each have specific areas of considerable experience in promoting international cooperation, and both are held in high regard for their contributions to the international fusion energy program. While each Agency's program arose from a different imperative, fusion research has been an important element of both programs since each Agency's inception, and these roles are complementary.

The IEA has been engaged in international fusion energy research cooperation since its inception in 1974, and the IAEA since its inception in 1957. The fusion work carried out under each Agency has been evolving to the present point and can well continue to evolve as the needs of the participating Member States change. Consequently, the following characterizations, containing both common abilities and unique strengths, describe current activities rather than limiting any future possibilities.

The current activities of the two Agencies involve research collaborations, technical meetings, publications, and public information; each is guided by an advisory body. These activities are compared in Table 1. Both Agencies publish technical reports and public information literature. Both Agencies organize research collaborations and technical meetings, but the nature of the collaborations and meetings differ.

The IEA research collaborations usually involve implementing agreements on major advanced research activities among several laboratories, involving large budgets, for which a legal framework is needed. The IAEA research collaborations are currently of two kinds: the ITER collaboration, an independent, very substantial activity for which the IAEA provides limited support; and Coordinated Research Projects (CRPs), which involve numerous laboratories from both advanced and developing countries. Thus, the IEA currently deals more with large, high-budget projects involving a few countries, and the IAEA, except for ITER, deals more with lower-budget projects involving many countries.

In the area of technical meetings, the IEA organizes workshops focused on specific areas of interest to their members, such as fusion materials, large tokamaks, remote participation, and energy technology availability. The IAEA organizes the biennial Fusion Energy Conference, which attracts 600-800 participants from over 30 countries, and 4-6 Technical Committee Meetings each year on a wide variety of topics. The technical meetings organized by the two Agencies are complementary, not competitive. In an area where the interests of the two Agencies partially overlap, such as Remote Participation, the two Agencies jointly sponsored a meeting in 1999.

Some unique fusion activities associated with the IEA are:
- actual hardware based collaborations
- large projects involving significant resources, such as the International Fusion Materials Irradiation Facility
- certain coordination initiatives, such as Remote Participation,
- provision of a forum for broad programmatic discussions, development of action plans for collective work, and information exchange among senior program leaders (Fusion Power Co-ordinating Committee, FPCC).

Some unique fusion activities associated with the IAEA are:
- provision of nuclear, atomic, molecular, and plasma-material interaction data
- biennial Fusion Energy Conference
- Nuclear Fusion journal; World Survey of Activities in Controlled Fusion Research, and IFRC Status of Fusion Reports.
- promotion of international cooperation by developing countries with each other and with advanced countries
- provision of aid to developing countries, such as travel grants and Technical Cooperation projects (equipment grants, fellowships, expert visits)
- provision of auspices for and other support to ITER.

*) e-mail addresses: t.dolan@iaea.org, koichiro.nakamura@iea.org
While both Agencies are engaged in facilitating fusion research internationally, there are some differences in how they operate.

The IAEA activities are developed and implemented by Agency staff, taking into consideration advice from the International Fusion Research Council (IFRC). While the program of work under IEA auspices is formally under Agency direction, the actual work tasks are undertaken under the authority of legal agreements among the Parties. The IEA Executive Committees represent the authority for each agreed-upon task. Thus, the IEA staff has less authority over IEA programs than the IAEA staff has over IAEA fusion programs.

The IAEA has a large number of members with a very broad range of foreign and domestic policy positions while the IEA has a smaller number with a narrower range of both policy views. Further, the IAEA has more professional staff in the fusion research area than the IEA, and the structure for decision-making reflects this difference.

In order to avoid duplication of activities, the IEA and IAEA staff members communicate with each other periodically and attend the planning meetings (IFRC and FPCC meetings) of the other organization. Some of the IFRC members are also FPCC members, which further helps with coordination. Technical meetings of interest to both agencies, such as on Remote Participation and on fusion technology, may be jointly sponsored. Research topics of interest to both agencies, such as on Remote Participation and on fusion technology, may be jointly sponsored. Research topics of interest to both agencies could also be coordinated so that the strengths of each Agency could be used effectively. For example, if an IAEA Coordinated Research Project evolved towards a large joint experiment, then the parties involved might wish to consider the formation of an IEA implementing agreement.

Summary

The IAEA and IEA play complementary roles in facilitating international fusion research cooperation. These roles represent highly desirable contributions to fusion research through the pooling of limited human and financial resources. The two Agencies both coordinate research and organize technical meetings, but in different ways. They each have unique strengths and different modes of operation. In order to deal with potential overlaps and serve the fusion research community optimally, they are coordinating their activities.

Acknowledgement

Helpful comments were received from members of the FPCC and IFRC, especially from FPCC Chair Michael Roberts, who initiated this comparison.

### IAEA and IEA Activities in Fusion Research

<table>
<thead>
<tr>
<th>Activity</th>
<th>IAEA</th>
<th>IAEA</th>
</tr>
</thead>
</table>
| Research collaborations | Implementing agreements:  
• Three large tokamak facilities  
• Toroidal physics in, and plasma technologies of, tokamaks with poloidal field divertors  
• Plasma wall interaction in TEXTOR  
• Stellarator concept  
• Reversed field pinches  
• Fusion materials, with conceptual design study of International Fusion Materials Irradiation Facility  
• Nuclear technology of fusion reactors, with conceptual design study of high-volume plasma-based neutron source  
• Environmental, safety and economic aspects of fusion power  
• Inertial fusion energy (under development). | Coordinated research projects (CRP):  
• Plasma heating & diagnostics in developing countries  
• Applications of plasma physics & fusion technology  
• Comparison of compact toroid configurations  
• Activation cross sections for fusion technology  
• Radiative cooling rates of fusion plasma impurities  
• Atomic & plasma-wall interaction data for fusion reactor divertor modelling  
• Molecular data for plasma edge studies  
• Provision of auspices for ITER and assistance in publishing, joint fund management, hosting meetings, etc.  
• Proposed Research and Development Cooperation Programme (RDCP), |
### Technical Meetings
- Remote participation Working Group and workshops
- Fusion Materials Strategy and Planning Workshop
- Workshops on three large tokamak cooperation
- Other workshops are planned in the frame of IEA Fusion Power related Implementing Agreements
- Workshop on Energy Technology Availability
- OECD Megascience Forum

### Studies of Energy Scenarios
- "The World Energy Outlook 1999 Insights"

### Publications
- Energy Policies of IEA Countries 1999 Review
- International Collaboration in Energy Technology: A Sampling of Success Stories (1999 IEA)
- Energy Technologies for the 21st Century (1997 IEA)
- Energy Technology Availability to Mitigate Future Greenhouse Gas Emissions (1997 IEA)
- Under each of the IEA Implementing Agreements annual technical progress reports and technical documents are issued.
- Book Energy from Inertial Fusion
- Journal Nuclear Fusion
- World Survey of Activities in Controlled Fusion Research
- Proceedings of IAEA TCM in technical journals
- Research Using Small Tokamaks, IAEA-TECDOC-969
- ITER documents (design reports, Council proceedings, Newsletter, etc.)
- Periodic report on status of fusion research by the IFRC (1990, 2001)
- Inertial Fusion Energy Research, IAEA-TECDOC-1136

### Public Information & Service
- IEA Internet Home-Page
- IEA Energy Technology and R&D (Brochures)
- Physics Activities brochure (Brochures are also published by ITER)

The IEA implementing agreements are usually hardware-based collaborations on unique experiments, common programs, or conceptual design studies, initiated by member countries. They involve 2-6 countries, which contribute substantially to the research. The IEA implementing agreements provide a legal framework and have involved major laboratories in major fields of research. The IEA is now encouraging participation by non-member countries.

Other collaborations may be developed in the future, as desired by Member States.

The IAEA CRPs usually have lower budgets, little associated hardware, and 8-16 countries involved. The exceptions are ITER, a major collaboration that functions independently, and the RDCP, which is not yet implemented. The IAEA collaborations are especially helpful to developing countries.

[Some CRPs and technical meetings are initiated by suggestions from Member States, and some by IAEA staff members, in consultation with the IFRC.]
<table>
<thead>
<tr>
<th>Aid to developing countries</th>
<th>Some Non-Member countries participate in the Implementing Agreements.</th>
<th>Technical co-operation projects (fellowships, expert visits, equipment grants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guiding bodies</td>
<td>FPCC meets annually. Programmatic discussions among senior program leaders and recommendations to the IEA. Large delegations of high-ranking people attend.</td>
<td>IFRC meets annually. Information exchange and recommendations to the IAEA. Senior scientists &amp; program leaders.</td>
</tr>
<tr>
<td>Comparison of Guiding bodies</td>
<td>The IFRC and FPCC are similar groups with some common members. Recently they have been working towards closer co-ordination of IEA and IAEA fusion research activities and participating in each other's meetings.</td>
<td></td>
</tr>
<tr>
<td>Governing Bodies</td>
<td>IEA Governing Board (24 Member Countries), Committee on Energy Research and Technology (CERT)</td>
<td>IAEA General Conference (130 Member States), which meets annually and IAEA Board of Governors, which meets 4 times per year.</td>
</tr>
<tr>
<td>Agency full-time equivalent professional staff dealing with fusion</td>
<td>Head, Energy Technology Collaboration Division: part-time Principal Administrator: 1</td>
<td>≈ 4.3</td>
</tr>
</tbody>
</table>