No longer splitting hairs over splitting atoms?

July 29 2008

As public opinion shifts and many more governments around the world consider nuclear energy as a solution to climate concerns and energy security, it is time to ask why it has become a more attractive option. The Institute of Physics (IOP) ran two sessions at this year's Euroscience Open Forum (ESOF 2008) to hold a public discussion about the future for both nuclear fission and fusion as sources of electricity.

The six speakers and the seminars' chair, Fritz Wagner, President of the European Physical Society (EPS), provided the audiences with an update on why power derived from nuclear fission has become one of the key solutions to baseload electricity and climate change concerns and how fusion, a very attractive source of virtually limitless electricity, that mimics the processes inside Sun to produce energy on Earth, can be made available to mankind.

If the nuclear plants currently generating electricity in Europe were shut down and replaced with fossil fuel-derived power plants, 700 million more tonnes of carbon dioxide would be emitted each year, equivalent to doubling the number of cars on European roads.

Although there are greenhouse gas emissions associated with the mining, enrichment and fuel fabrication of uranium, and the construction of nuclear power plants, they are very small in comparison with the emissions of stations burning fossil fuels and comparable with the emissions from renewable electricity sources like wind, wave and solar. Over the life time of a nuclear power plant or a wind farm, both emit approximately five grams of CO_2 for every kilowatt hour of energy produced, whereas coal can produce more than 1,000 grams and gas typically produces approximately 500 grams.

As Adrian Bull, UK stakeholder manager for Westinghouse, a global nuclear company, said during the fission session, “Comparing the greenhouse gas emissions of nuclear power plants with those from renewables is like comparing the calorie content of cucumbers and lettuces.”

International energy security and the rising cost of energy were also discussed by all three speakers in the fission session. The world’s uranium supplies are fairly evenly spread across the globe so a relatively constant supply of uranium can be guaranteed without political implications and as the main cost of nuclear power plants is the capital investment required for nuclear build, it is possible to predict the cost of nuclear energy up to 60 years in advance.

After the seminar, discussion ensued with the audience, who asked questions about the problem of nuclear waste and other issues. On nuclear waste, Bill Nuttall, Senior Lecturer in Technology Policy at the University of Cambridge, said, “The fact is that we are only just waking up to the consequences of those wastes which we haven’t managed through the burning of fossil fuels but we can at least manage nuclear waste.”

In the second session, three fusion scientists explained their research into a totally new source of electricity. Electricity derived from fusion stems from the joining, rather than the splitting, of nuclei. The process was achieved in laboratory experiments in the second half of the twentieth century, but has yet to realise its potential as a source of electricity.

One clear advantage of fusion is its inherent safety and that the volume of the radioactive waste produced would be vastly lower than that from fission. Also, the radioactive isotopes would be very short lived so that waste would only need to be stored securely for up to 100 years.

Fusion power also has enormous fuel reserves, which could last for several thousand years. David Ward from UKAEA Culham, the home of UK's fusion programme, said, "The lithium found in a laptop computer battery would be enough fusion fuel to provide an average European's lifetime electricity needs."

The main research programme for fusion is ITER, an experimental reactor, under construction in Cadarache, France.

David Campbell, Assistant Deputy Director General for Fusion Science and Technology for the project told the audience that the machine is due to start operating in 2018. It is an international collaboration, including representatives from over half of the world's nations.

ITER is designed to confine a plasma producing about 500MW of fusion power for at least several hundred seconds and to provide the scientific, and much of the technological, basis for the construction of a fusion reactor which could supply electricity to the grid. During the design phase, an extensive R&D programme has demonstrated much of the technology required to build ITER.

One of the main scientific challenges remaining for fusion is the development of materials that can withstand radiation and plasma temperatures ten to twenty times hotter than the centre of the Sun, to line the inner walls of fusion reactors.Harald Bolt, member of the Board of Nuclear Research Center, Juelich, Germany, explained how physicists are also developing these to minimise the amount of radioactivity arising from the extreme conditions.

Discussion with the audience afterwards touched on a number of topics including the cost pressures on ITER from such influences as rising oil and steel prices and the impact of the US Congress' decision to zero this year's US contribution to ITER (now partially reversed). The question of whether some of the coutries in the Far East were likely to accelerate their fusion research programmes to the extent that they, rather than Europe, might build the first fusion power plant was also raised.

Many of the 200 visitors to the sessions, including journalists, policy-makers, students and those with just a general interest, commented on the success of the two sessions as thorough and timely overviews of developments in fission and fusion power.

Provided by Institute of Physics

Citation: No longer splitting hairs over splitting atoms? (2008, July 29) retrieved 18 April 2024 from https://phys.org/news/2008-07-longer-hairs-atoms.html