

Panel Sustainability and New Energy Systems (August 21, 8:30-9:15)

Moderator: Rakesh Agrawal

Panelists: Ofelia de Araujo, Ana Eliceche, Paul Stuart

Rapporteur: Ana Eliceche

1) Energy and Sustainability: are they the same?

Rakesh Agrawal: Energy is perhaps among the biggest issues in sustainability. Furthermore, as research area energy it is a great opportunity for chemical engineers, especially for PSE researchers since they are equipped to make contributions to the development of new processes.

Ana Eliceche: The current worldwide trend of increasing energy demand generated mainly with the use of fossil fuels is not sustainable. Thus, there is a need of reducing energy consumption and changing the pattern of energy generation switching to the use of renewable resources, as has been mentioned in this conference. Chemical engineering and PSE community can contribute in both aspects.

Ofelia de Araujo:

The technical contribution of professionals understanding the main phenomena is relevant, mainly when human actions have significant consequences in nature, as the case of carbon dioxide sequestration and geologic storage - CCGS. International regulations should be reinforced to guaranty safe operations. All relevant information about risks, site quality and prices should be accessible to all society agents in the CCGS.

2) What are the major intellectual challenges in these areas from a PSE viewpoint?

Rakesh Agrawal: A major challenge is trying to figure out on the one hand how to advance each of the energy technologies; e.g. solar, hydrogen, biofuels, and on the other hand how to best combine them so as to obtain synergies like for instance developing processes where there is no net formation of CO₂ as in the H₂CAR process that we have devised for liquid fuels for transportation.

Paul Stuart: A major challenge is devising solutions to energy problems that are cost effective. Unless we do that, industry will not adopt new technologies or approaches developed by academia. Another major challenge is the development of life cycle analysis tools that can be easily interpreted by industry and government.

Ana Eliceche: The major intellectual challenge is probably to contribute to environmental sustainability, with the PSE expertise adapting to a new paradigm. The difficulties of the system to be studied will increase, expanding the limits to include the main burdens in the context of life cycle analysis and evaluating the global potential environmental impact in nature. Thus, uncertainties increase in defining the new limits, which processes to consider, their modelling, availability of data to be used, etc. PSE community has the opportunity and the background to formulate and solve these tasks.

3) What are promising and not so promising energy technologies in which to engage research efforts? (eg is it worth to concentrate on biomass ?)

Rakesh Agrawal: Although it is clear that biofuels by themselves cannot solve the energy problem, they can still be effective if combined or integrated with other technologies. Solar energy is an attractive option because the source is almost infinite and the percentage we currently capture is extremely small. Global efficiencies of different energy generators should also be considered.

Ofelia de Araujo: Brazil has tremendous natural resources, so it makes sense to look at biomass as a major source of energy. However, biodiversity is a relevant issue and crops for energy may play a negative impact in such aspect.

Paul Stuart: Canada has also tremendous natural resources, particularly vast areas of forests. So it also makes sense to examine how to best exploit these resources, possibly as part of paper mills. It is important to be in touch with the real world as a source of data and problems to be solved, as industrial plants.

Ana Eliceche: Environmental life cycle analysis can support a decision making process in order to evaluate which energy technologies can contribute to a sustainable development. In the case of bio fuels, the environmental impact of the use of land competing with agriculture for food and the expansion of the area for agriculture at the expenses of natural forests, like the Amazon, should be considered. Perhaps bio fuels from wastes are a sustainable alternative, at small and medium size plants. The range of wastes that can be burned or used to generate biodiesel or bioethanol is wide, so there are many opportunities. Two aspects like treatment and disposal of wastes together with energy generation are tackled simultaneously. In general wastes can be thought as raw materials for further recovery, recycle and re use, to reduce final disposal.

4) If you were a young Asst Prof, would you devote all your efforts to Sustainability and Energy?

Rakesh Agrawal: Without any doubt, for me it would be energy. That is the most pressing problem that human mankind will be facing in the future. That is the area where a young professor can make the biggest impact. However, a young professor should work in an area where his or her passion is. In the end it is about being excited with whatever one is doing.

Ofelia de Araujo and Paul Stuart: Totally agree with Rakesh.

Ana Eliceche: I would devote most of the efforts to Sustainability, switching from a development based in an intensive use of cheap non renewable resources to a more sustainable development. A worthwhile contribution could be achieved focussing the research in reducing the environmental life cycle impact of processes. Reduce the consumption of non renewable and scarce resources like water and reduce also the generation of emissions, effluents and wastes in the sources. Try to copy Nature as much as possible. And as Rakesh has said, work in an area where your passion is to feel excited about your research.

Comments and or questions from the audience

Ignacio Grossmann: noted that research on water treatment and water issues are mainly based in Civil Engineering Departments rather than in Chemical Engineering Departments. Furthermore, in the US Civil Engineering has taken the lead in Environmental Engineering and Sustainability programs although they do not necessarily have the required technical expertise to address such problems.

Rakesh Agrawal: Probably this is due to Civil Engineering professional tradition in the design and construction of water distribution and water treatment facilities.

Ana Eliceche: Courses and books in Environmental Engineering have been originated in civil engineering while research and books on Pollution Prevention have been originated in chemical engineering and particularly PSE researchers. The role of Chemical engineering and PSE community is crucial in promoting the industrial application of new and cleaner technologies. They have the expertise and the tools to be applied in new processes and the combination of new and existing ones. The collaboration with researchers that have a deeper understanding on the new processes and can generate experimental data for model validation is recommended whenever possible. The PSE expertise, in formulating problems and developing alternative strategies to generate solutions, would contribute to gain insight and help to improve new processes.

Ofelia Araujo:

Civil engineering is currently in the lead regarding environmental engineering and therefore chemical engineers should occupy a more relevant position. Engineers should also lead because environmental economists tend to underestimate the technical aspects. I recently read a paper with a very intriguing reference: “The economic efficiency of storing CO₂ in leaky reservoirs”.

Angel Irabien: Sustainability requires a multidisciplinary approach and therefore the contribution of different University departments and views is expected, but PSE is very well connected to innovation strategies in energy. Renewable energies, global warming (and related issues) and energy optimization in processes and products are going to be important research, development and innovation activities for PSE.

Comment from a North American (USA) postgraduate student expressing his concerns on the need of including these concepts in the Chemical Engineering curricula. He also mentioned that there are courses on green chemistry for example in some Chem. Eng. curricula in the USA.

Ana Eliceche: Pollution prevention courses perhaps should be offered as optional courses. An Environmental engineering course has been introduced as a compulsory course in some Chemical Engineering undergraduate curricula in Argentina, to comply with the national accreditation recommendations. The classical Environmental engineering courses are focused mainly on end of pipe technologies, while pollution prevention strategies are not emphasized.