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A bus powered by a fuel cell, undergoing trials under the aegis of the European CUTE Program, in front of a hydrogen fueling station in Hamburg. Introduction of hydrogen as an energy carrier requires not only development of high-performance, economical converters, but also deployment of an entire production and distribution pathway.

I. THE HYDROGEN PATHWAY

For reasons having as much to do with economics as with ecology, it would seem the time of hydrogen as an energy carrier has come. If it is to become established in this role, answers have to be provided as to the crucial issues still standing, and first and foremost: how is that hydrogen to be produced, with little or no greenhouse gas emissions?

The choice will have to be made between processes, of which some are still at the basic research stage. Two such processes at least are eliciting interest at CEA: water splitting, by electrolysis or high-temperature chemical reactions (using heat that might be generated by nuclear reactors), and thermal decomposition of biomass.

The second issue concerns the infrastructure that needs to be deployed, through to storage on board vehicles, this presenting a real challenge to research workers.

With the related issue: would it not be advisable, initially at least, to go for in-situ production of hydrogen from conventional feedstocks?

An energy carrier entails use of converters. In this respect, fuel cells are seen as having all the right answers, and do appear inherently bound up with hydrogen. With respect to the various members of this extensive family, application-dictated requirements differ widely. CEA research workers and engineers have been addressing - drawing on a thoroughgoing understanding of the state of the art - the scientific and technological difficulties arising in both of the main pathways (PEMFCs, and SOFCs). Their aim? To devise a sufficient number of strong, serviceable "building blocks," to enable them to offer original solutions to manufacturers. They have further embarked, using their experience in microelectronics, on development of microgenerators, which could find early applications, in telecommunications for instance.

The issue of safety is the key to acceptance of hydrogen by government, whose remit it is to draw up regulations governing its use, and the public at large, who would come across it in two applications particularly close to its heart: the automobile, and at an earlier date still, the portable phone.

All of which issues govern the deployment of structured industrial pathways, with support from government, this being more or less extensive, depending on the world region involved. After some delay in defining a policy, the European Union would seem to be intent in holding its own in this area. A drive to which France is making its contribution, with CEA playing a central role.