Discussion

Harry Singh

Q: In the scheme of the competitive power markets shown in your presentation, the market mechanism itself is not based on technology. Also, without any rigid ground, this market mechanism is automatically assumed to lead power delivery service to its optimal state. It is important to know if this fundamental assumption is true.
A: No, there is not any rigid technical ground for this first assumption. However, there have been a lot of discussions on the competitive power markets, and the modification of the market scheme is being carried out for its optimization.

Q: Do you think that fuel cells will have any impact on competitive power markets?
A: For any specific technology, it is difficult for me to evaluate its potential importance to the power network system from a technological point of view. However, for the power market exchange mechanism, distributed power resources would not play a significant role in the bulk power exchange, since they are connected to the low-voltage distribution lines and thus no direct influence can be expected other than increased power competition.

Karen Miu

Q: The integration of distributed power resources would give a further complication to the distribution system. What measures can you take for the increased introduction of distributed resources such as fuel cells?
A: It is a challenge to find countermeasures for the increasing complexity of the networked distribution system. The integration of a few distributed resources to a distribution system is definitely feasible, though the evaluation of the impact becomes more difficult when the number of distributed resources to a single distribution line is increased.

Masayoshi Ishida

Q: Metal hydride is rather expensive at present. Do you believe that a fuel cell system with metal hydride storage will be able to achieve substantial cost savings?
A: The proposed system here is only conceptual at present, and the production cost of the system has not been evaluated yet. For a further evaluation, it will be necessary to talk to providers of metal hydride material and system manufacturers.

Q: Why does system efficiency increase when metal hydride storage is used?
A: As explained, the steam reforming system becomes less efficient at its partial load

operation. By producing hydrogen at a higher load condition where the conversion efficiency is expected to be higher, and by storing hydrogen excessively produced to the metal hydride, we can minimize the loss occurring for the steam reforming process.

Comment: For your proposed combined hydrogen production and storage system, it would be most efficient when you apply your concept at a community level rather than to an individual household. In particular, there would be less energy loss when distributing energy as hydrogen than as hot water in a community energy network.

Q: Perhaps a stand-alone system as you proposed will be most suitable for applications in remote areas and some developing countries?
A: Yes. It is true that such remote applications can be well within the scope of the proposed system.

Q: What is the benefit of using a hydrogen storage system rather than a battery system?
A: Perhaps it would be the efficiency of energy storage. Storing energy in the form of hydrogen would be more efficient than using batteries.

Q: In your proposed local network system, what is the optimal electricity capacity? I think that there will be a substantial loss of heat when delivering it to the points of consumption.
A: Again, the proposed local network system is only a conceptual idea. Detailed definition of the system has not been evaluated.

Tomio Tamakoshi (on behalf of Taku Oshima)

Q: NaS batteries are operated at an elevated temperature of around 300ºC. How do you manage to maintain battery temperature when applied as UPS (Uninterrupted Power System: a power backup system for unexpected blackouts)?
A: For ordinary conditions, NaS batteries are maintained at a certain level of temperature by heating up by a heater. In the event of an emergency, the DC electric power can be delivered from the storage batteries.

Q: Do you think that it is possible to use NaS batteries for automobile and residential applications?
A: For automobile applications, although there was an effort in the past, there are no such activities at present as far as I understand. For residential applications, the capacity of power required is so small that no economical operation can be expected.

Q: In what manner do NaS batteries deteriorate in their performance?
A: With longer operation time, the internal resistance of NaS batteries increases, leading to a substantial decrease in power storage capacity. Therefore, the batteries are still operational from the technical point of view, but it restricts the economy of operation.

Q: After 15 years of operation, are you going to recycle the materials used for the NaS batteries; for instance, Na and S?

A: It is our plan to recycle all the material used.

Q: You have controlled the crystal structure of electrolytes and in particular chosen non-isotropic structures to improve conductivity. I assume that it would be much better to use isotropic structures rather than non-isotropic structures in view of networking the electrolyte grains. Could you comment on this?
A: The non-isotropic structure chosen here shows high conductivity along its lengthwise orientation. Isotropy of structure is important to maintain the strength of the electrolyte material. Thus, there is a trade-off relationship between strength and conductivity of the material.