Flexible Electricity Systems

Integrated Energy Systems of the Future

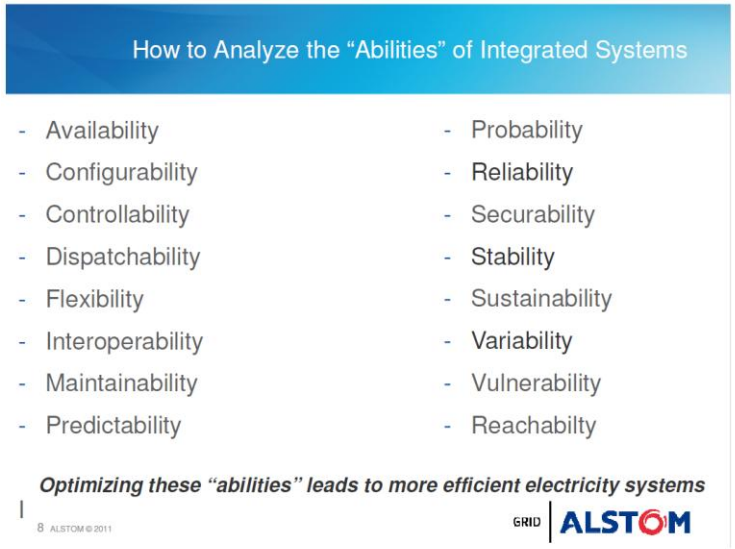
7, 8 November, 2011

Summary of Workshop

Agenda Item	Speaker
Welcome and Introduction	Peter Cunz, CERT Chair
	Bo Diczfalusy, *IEA Director SPT*
Introduction & Objectives	Markus Wråke, *Head Energy Technology Perspectives*
	David Elzinga, IEA
The systems approach	***Keynote Speakers:*** ***Dr. Mark Barrett, UCL Energy Inst.; Dr. Lawrence Jones, Alstom Grid Inc.;*** ***Kari Espegren, IFE***
The Future Energy Picture and Introduction to afternoon sessions	IEA Analyst presentations
Heat – pushing the hot buttons!	**IEA Lead:** Jayen Veerapen
Flexible electricity systems	**IEA Lead:** David Elzinga
On our way to a Hydrogen Future?	**IEA Lead:** Lew Fulton
Summary of breakouts-	
Energy systems in emerging economies and developing countries	**IEA Lead:** Steve Heinen

Quotes from the Keynote: Electricity

- How many things are judged impossible before they actually happen? (*Pliny the Elder, Naturalis Historia, VII)*
- "We must retain and extend the value of a legacy investment through migration to new technology platforms."



Quotes from the Keynotes: Hydrogen

- Complentarity - not competition - is needed between energy technologies.
- Hydrogen and electricity are the only to non-carbon energy carries.
- Balancing of variable renewables is a significant driver for hydrogen and hydrogen storage and technologies.

The applications of hydrogen:

Quotes from the Keynotes: Heat

- We need to examine the 2050 time frame, seasonal time frames and minute by minute timeframes.
- In the UK – modeling suggests going from existing system to an electricity based system.
- Long term development time frames are needed in the heat sector – change will not be a one time event– we need to consider decades.

Heat Breakout

- Demands are more important than supply both in cooling and heating – they must be examined first.
- Heat demands will reduce in the future with ambition of using less heat for heating buildings.
- Synergies with other energy systems:
  - Very few today.
  - Strong potential with electricity sector in order to deliver a balancing power service .
  - Synthetic fuels will result in more heat losses which will have to be recovered in the future to be efficient.
- Water: it is used for cooling both in electricity and industrial plants.
  - If short of water how can we transfer heat?
  - If we use the heat in building, the buildings will become the cooling towers in the future.

Electricity Breakout

- Focussed on the flexible electricity system:
  - Four resources: generation, interconnection, demand response and storage.
- In the near term interconnection and generation as the key technologies
- Maturity is not yet there for demand response or storage to provide reliable, large-scale flexibility yet.
- Price signals to the end-user are important – but we have to get them right
  - Simple increase in the $/kwh will not be enough
  - More sophisticated tarrifs are needed – like cell phones.
- How to operate an electricity system (in order):
  - Step 1: produce electricity when you need it,
  - Step 2: use it when you have it
  - Step 3: store it when you must.
- Analysis of flexibility requires an understanding of the 3 time frames: short, medium and long.

Hydrogen breakout

- Interesting what we didn't talk about: Will fuel cells work, can you store hydrogen? The debate is maturing.
- Denmark – recent study – how they will achieve high level wind penetration objective – see little alternative to hydrogen.
- It is no longer about can we make fuel cells and deploy - but should we? Serious initiatives now under way in several parts of the world to demonstrate and prove how you roll out fuel cell vehicles at significant scale.
- Efficiency and economics of using hydrogen with renewable has to be understood carefully.
- Hydrogen is not just a molecule in a fuel cell but how you use it to extend other fuels or other energy carriers. Blending hydrogen etc, ammonia, etc. System thinking – not just making hydrogen and putting through a conversion device.
- If the hydrogen community in conjunction with renewables make it available - what can other sectors do with it? The built environment – will it be truly applicable to new and existing buildings?
- There is a role for hydrogen, not completely understood, but working on it and there is a bigger vision for what can be done beyond.

Quotes (and questions) throughout the day:

Integration of energy systems is needed in our energy future!

What's going to happen to the gas grid if we move to an electricity based society?

Systems thinking is difficult and complex – can policy makers understand it? How can we best explain it?

Shale gas has changed our assumptions – but how?

Technology deployed in developing countries has to be flexible, adaptable and scalable.

Don't forget – there is a difference between finance and economics. Just because it is economical – doesn't mean it is financeable.

Interesting topics that came up

- The energy water nexus
- Capacity building through technology specific roadmapping guides
- Smart City/Urban Infrastructure
- What is the global storage availability and where?

The key comments:

- "Cannot achieve high penetration without a storage medium. And if you want that medium to store more than low quantities of energy then unlikely to have an alternative to hydrogen."
- "In 50 years heat demand will be significantly lessened and therefore we may not have this resource available – especially at the building level"
- If the future is "electricity" shouldn't all the other energy systems/carriers be designed to simply support this single system?