REPORT OF THE 2ND VANITEC ENERGY STORAGE COMMITTEE MEETING

Held on 30 June 2017
At Manchester, UK

PRESENT:

See separate attendance list & powerpoint presentation.

1. WELCOME & ANTITRUST – John Hilbert & Vincent Algar

Mr John Hilbert opened the meeting and welcomed everyone present. Vincent Algar reviewed the agenda and objectives for the day.

Mr John Hilbert reminded all participants of the need to adhere to Vanitec Antitrust Guidelines at all times during the meeting with no discussion of future price, market share and the future need in term of what the price to be.

2. MARKET UPDATE – Terry Perles

- Production V limited by material
- PRC 7/7/17 new rebar law comes into effect 1.2 Yield strength ratio and elongation properties
- Solar and CCGT price parody
- Today world production equates to 16GWh of storage

3. FINANCING & LEASING OPTIONS – Alberto Arias

- Goldman Sachs leasing metals, VE very recyclable
- Lease of Pt to oil refineries for CAPEX
- Cobalt 27
- Options at end of term:
    - Buy
    - Recycle
    - Re-lease
- Would apply to larger systems

Q's & A's:

- Copper contamination (Peter Fisher)? Would require the OEM's input and insurance
- Insurance? Such as Allianz (PVH)
- Annual lease costs? 3 to 10% 10% is maximum
    - Owner ultimately decides on cost structure

- How does it work? Could be Cobalt 27 model through Goldman maybe. Financial instrument or vehicle
- Lease whole system? Yes, this gives flexibility to company and tax benefit
- End users? Operating cost better than CAPEX & drops barriers to adoption

4. ELECTROLYTE STANDARDS – Peter Fischer

Q's: why doesn't thermal precipitation apply for mixed acid electrolytes?
A's: PNNL say it's due to complexation but Peter and Maria think it's probably got to do with Hydrogen ion concentration
Q's: os the reason you don't look at mixed acids because of patent?
A's: not really, more data available for the 1.6M standard electrolyte. Not enough basis in literature for PNNL technology

5. PANEL ON COMPETING TECHNOLGIES – Mikhail Nikomarov

- Lead acid, Li-ion and Vanadium are the only ones with significant investment

Statement (Peter Fisher) – there is little consistency with 3rd party numbers with batteries
Q's: How about fuel cells? Not as prevalent as Li-ion therefore not a major threat
Q's: selling power to the utilities, but why not to the people and who are the customers?
A's: there is a need to align advantages of tech with customer requirements and their focus
Q's: LCOE can this bite us back for instance with V lease costs?
A's: it depends very heavily on discount rate used
Statement Sumitomo: VRB not battery it's energy storage machine. Need RE with long duration ESS 6 to 8hrs. Mikhail said in 5 to 10 years VRB will come.

6. VRB PROMOTION – Vincent Algar

Q's: Why the naming inconsistencies with tech and VE?
A's Patent on VRB, VFB and VRFB. The company is TSX:VRB listed and taking legal action against some companies in North America and Canada
Statement: need a sexy name for technology and twitter handle/ name
Q's: is there enough vanadium? Yes but perception is that it's rare
Statement: Education about technology and Vanadium is critical; Vanitec needs to develop a marketing and promotion plan.

7. NEW SOURCES OF V – Michael Grimley

- Catalytic cracking of heavy oils containing V
- Ash has labile V, therefore leach into water
- GSA is now best in practice technology and older cement burying technology has to be proven to be better in Saudi

Q's: What's potential world production? Difficult to define, Saudi's don't use their own oil in power stations, Canada roughly 100K tonnes/yr.
Q's: Major hurdles? GSA hasn't been able to unlock CAPEX from oil companies or utilities, margin low.
Q's: How did you get hands on catalyst if catalyst manufacturer has IP in structure?

A's: just got sent the material, or went to refinery. Refineries buy catalysts therefore do what they want with it.

9. VANADIUM IN ADVANCED ENERGY TECHNOLOGY – Texas A&M

Q's: Where do you get funding from? Numerous sponsors some include government (defense department), industry and companies.
Q's does the Zeta V_2O_5 thermo-decompose? At 600 Celsius, but propose to use it with Mg-ion therefore no dendrites.
Q's: when's commercialization? Window technology is about 2yrs away and Start-up Company already floated. The magnesium battery is +5 yrs away.

10. HSE COMMITTEE – Dr. Len Levy

Due to the lack of time, Dr. Levy just reviewed the purpose and activies of the HSE Committee and noted they will be meeting again in October but have monthly calls if any Vanitec member wants to join.

11. NEXT MEETING

The 3rd ESC meeting will take place on 10 October 2017 at Sheraton Skyline Hotel in London, UK

Reported By
John Hilbert