

# Development of a Draft Battery Performance Standard

## Webinar 1

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23 November 2018

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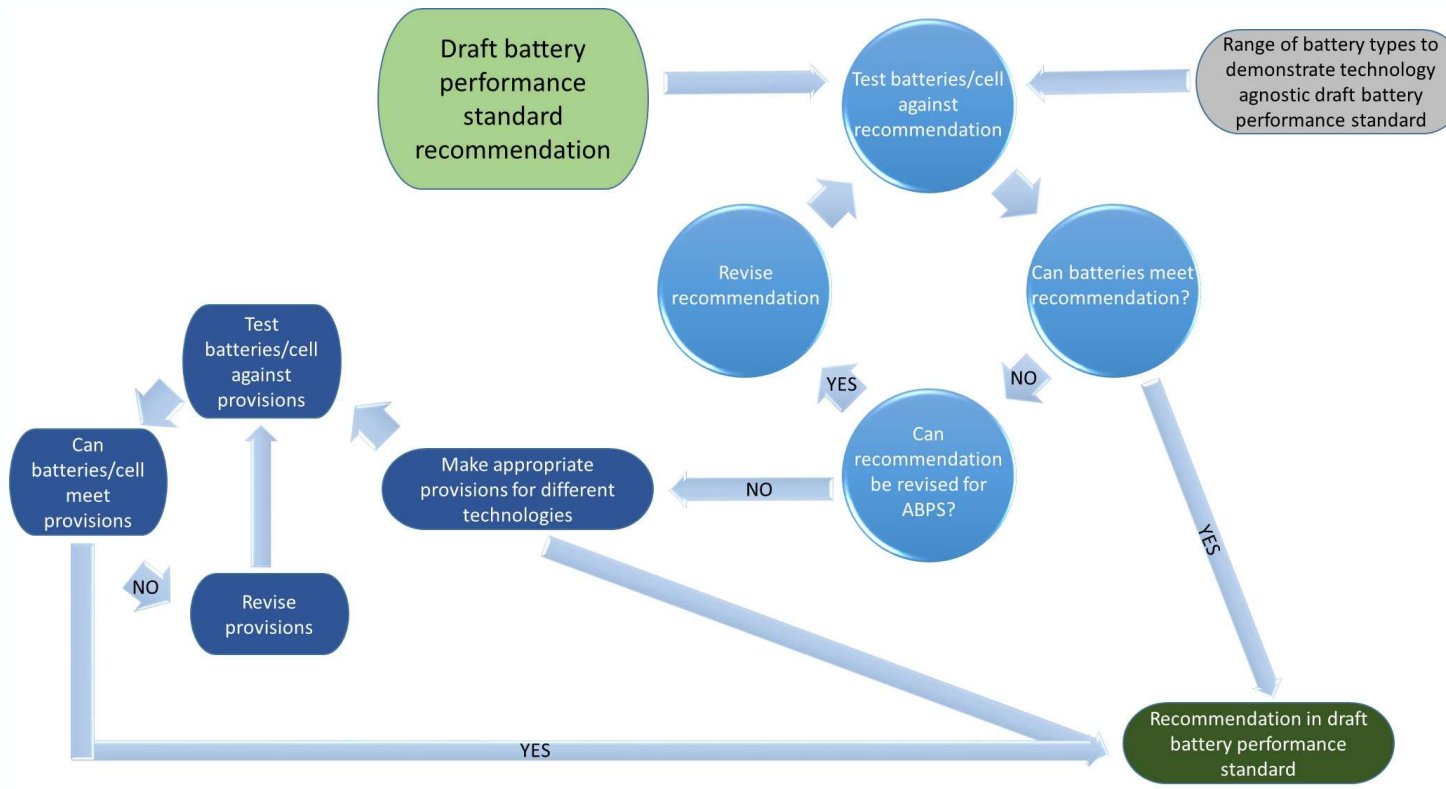
# Battery Selection

- The problem: current method of performance measurement are not standard and creates confusion
- The solution:
  - Standardised performance evaluation method and conditions for all battery systems
    - Application specific
    - Battery technology agnostic
    - Applicable to all levels from cell through to system
    - Validated through example laboratory evaluations



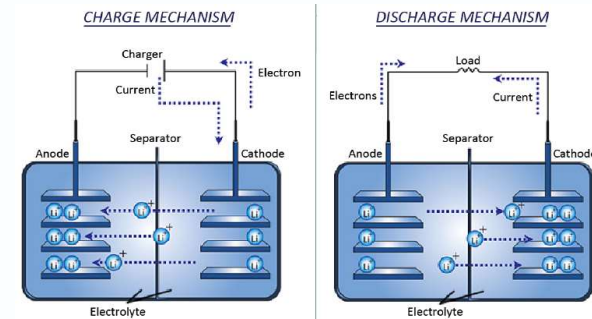
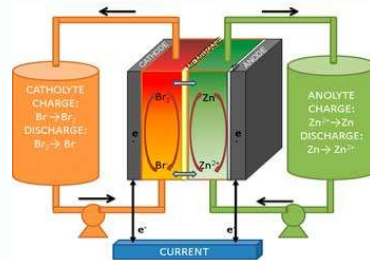
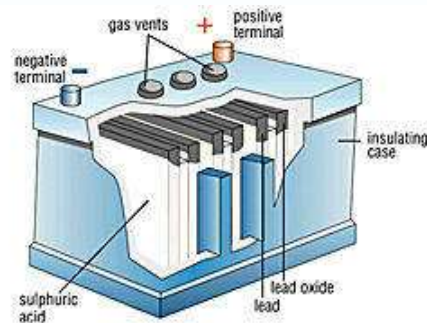
# Battery Selection

- Use laboratory testing to guide Standards recommendations development



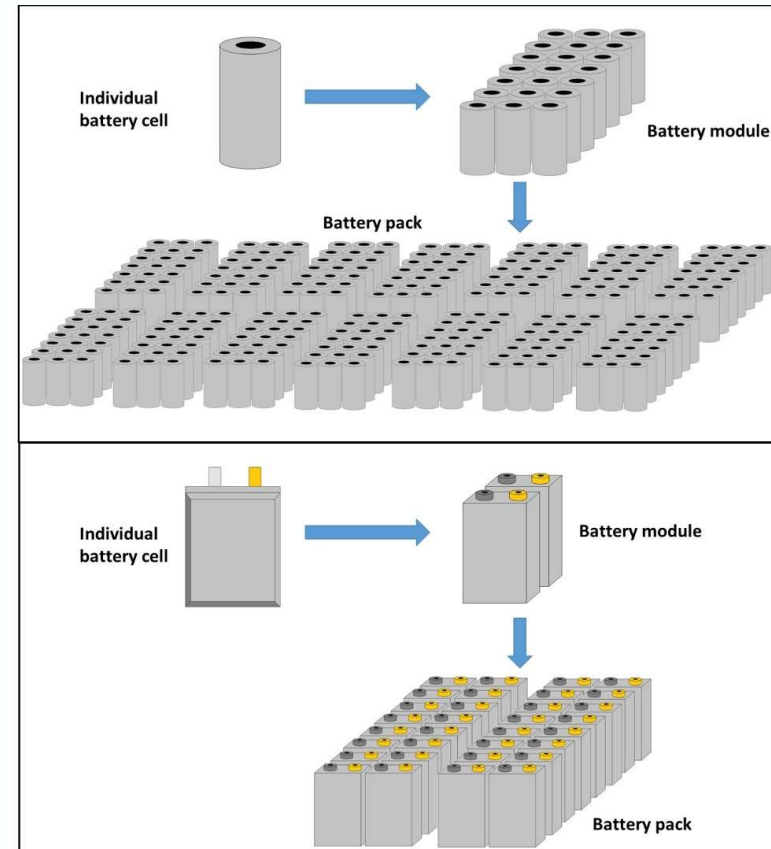
# Battery Evaluation

- Standard should be applicable for all levels of the battery energy storage system
  - Means testing can be performed by anyone in the entire supply chain
  - Chemistry agnostic – applicable to all current and emerging systems
  - Application specific – different applications will have different performance metrics applicability



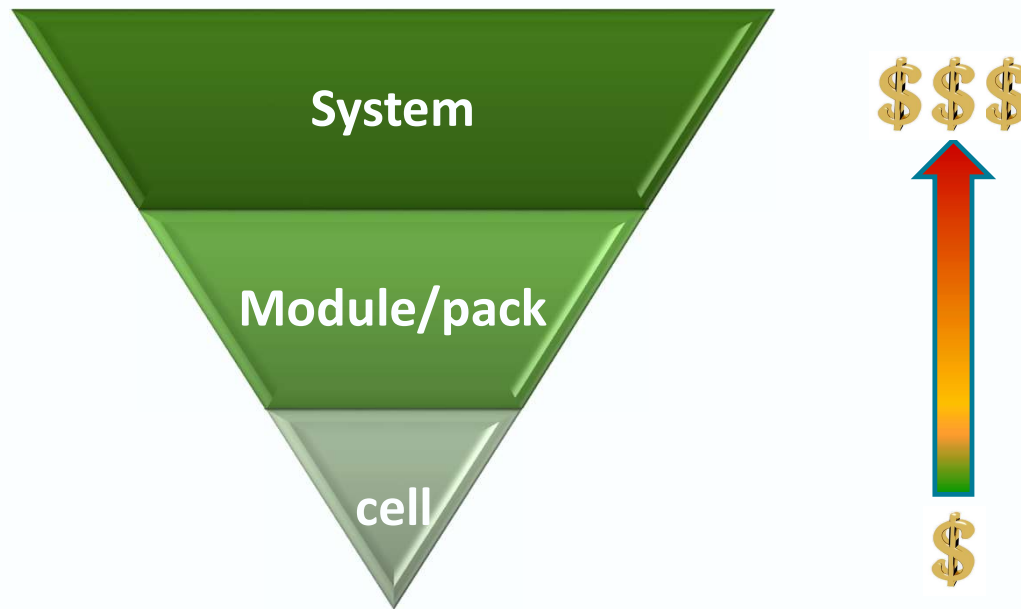
# Battery Evaluation

- Battery Energy Systems designs vary across different manufacturers and battery types.
- All the energy in a system is from the smallest battery unit (cell/module or pack dependent on chemistry type)
- Overall system hardware influences cell/pack/module performance



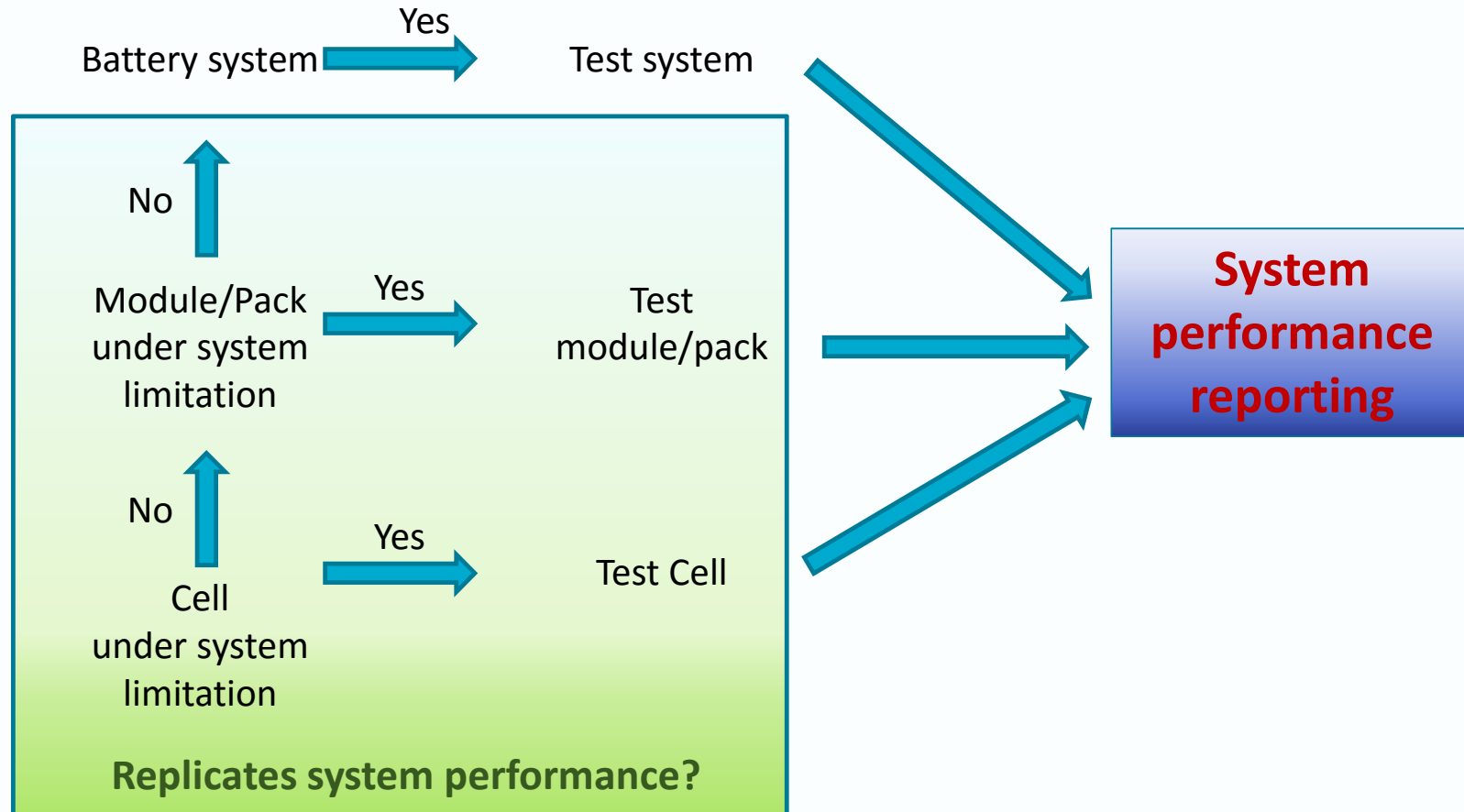
Li-ion battery pack construction example

# Battery testing



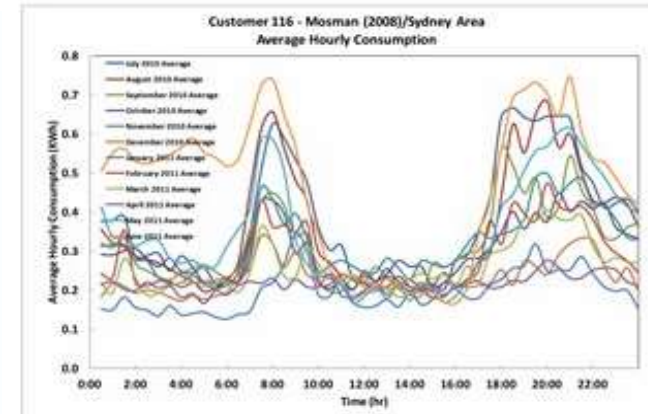
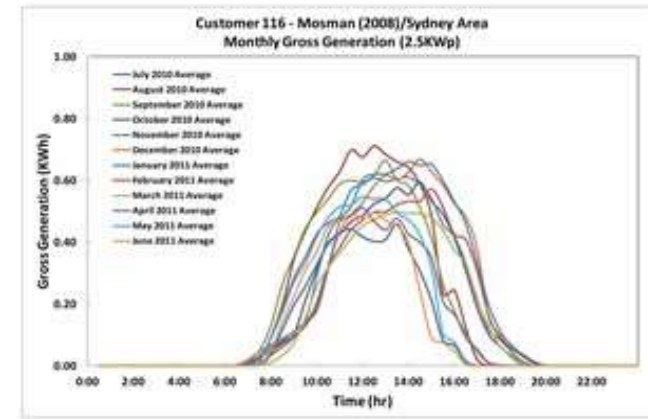
- Increasing energy, current, voltage, power etc.
- Increased cost of testing equipment
- Increased training
- Etc.

# Battery Testing



# Battery Evaluation

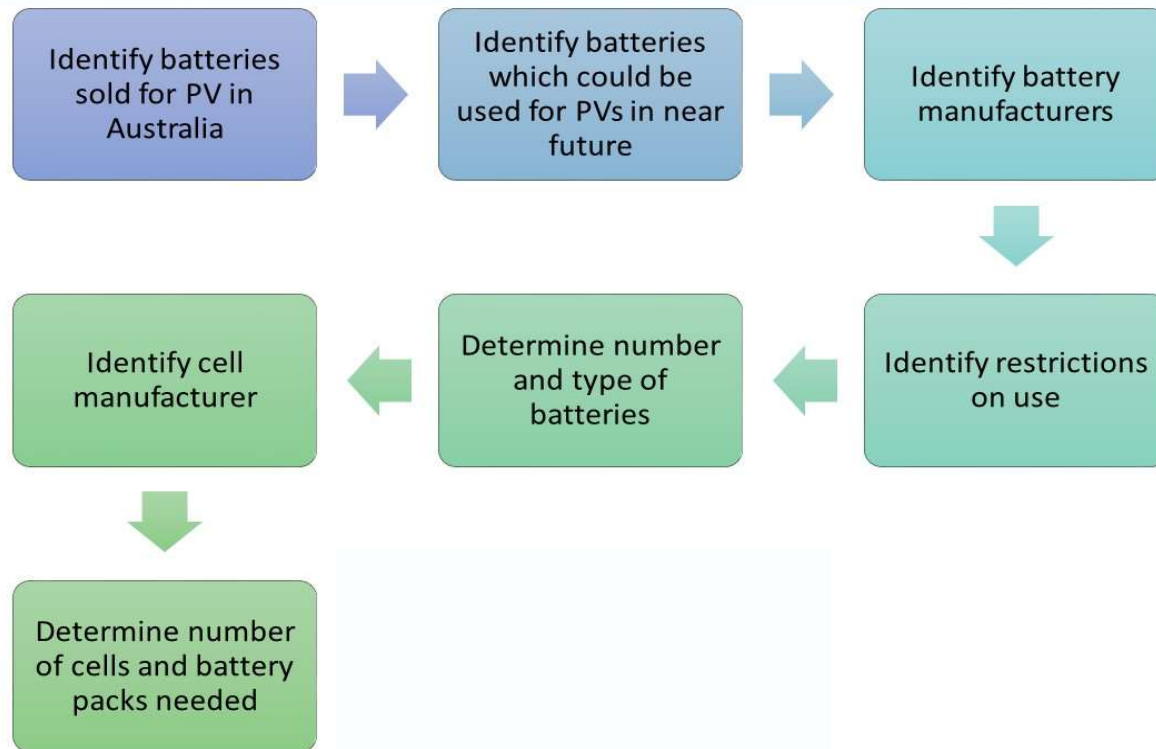
- Identify different applications in residential to light commercial space
- Use real life data (where available) to develop a simulated “application cycle”
- Identify performance metrics applicable to these cycles, for example:
  - Cycle life (charge/discharge based)
  - Energy throughput
  - Power
  - Depth of Discharge range
  - Temperature range
  - Etc.
- Propose performance metrics for each drive cycle/application
- Evaluate battery and ensure metrics are suitable for use





# Battery Selection

- Battery selection guide/process



# Battery Selection

Battery Type	System	Cell or Module	Comments
Nickel-cobalt-aluminium oxide (NCA)	Yes	Yes	
Nickel-manganese-cobalt oxide (NMC)	Yes	Yes	
lithium titanate	Yes	Yes	
ZnBr flow	Yes		Light commercial
Lithium iron phosphate (LiFePO <sub>4</sub> )	Yes	Yes	
Lithium manganese oxide		Yes	Technology agnostic demonstrator
NaNi	Yes		Technology agnostic demonstrator
Advanced lead acid		Yes	
Lead acid		Yes	Only suitable formats chosen
Supercapacitors		Yes	claimed for application

# Battery Evaluation

- **Step 1: Calibrate batteries and systems**
  - Identify poor battery/system and replace, exact testing conditions – ensure battery and systems are being fairly tested, limitations BMS or hardware limitations – ensure ongoing testing utilises these conditions
- **Step 2: Identify applications and develop “application cycle”**
  - Analyse solar irradiance, temperature and load profiles by season and State,
  - Develop “averaged” input, temperature and load profiles to simulate application for upper and lower limits
- **Step 3: Suggest draft battery performance standards recommendations**
  - From previous analysis identify key performance metrics e.g. cycle life, power etc., suggest performance metrics and recommendations for each different application type
- **Step 4: Identify system limitations and correlation factors**
  - Identify system (hardware or BMS) limitations of cell/modules, Investigate system performance, investigate cell/module performance under system limitations, demonstrate correlation and variance factors
- **Step 5: Validate recommendations**
  - Test recommendations from Step 3 under a range of systems/modules and cells
    - Identify where recommendations need modification and retest, identify where provisions need to be made for specific battery chemistries and incorporate in draft standard , identify where recommendations cannot be used and draft new recommendations
  - Identify performance metrics measurement methodology for each application type
    - Specify conditions such as current, voltage, time, power, temperature etc., specify how each metric should be measured, specify how each metric should be reported
- **Step 6: Draft standard with validated recommendations**

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