

## Battery Developments

### Future Energy Scenarios 2012

Denis Naberezhnykh

27<sup>th</sup> September 2012



# EV Battery Reuse

Technology Strategy Board  
Driving Innovation

- TSB co-funded project
- “Feasibility of re-using electric vehicle batteries for electricity storage in the utilities sector” (TSB ref: 130712)

- Partners:    

- Focus: Assess the feasibility of using EV battery technology in second life applications in the energy utilities sector.
- Report available early to mid-October.

# EV Battery Technology

## Performance

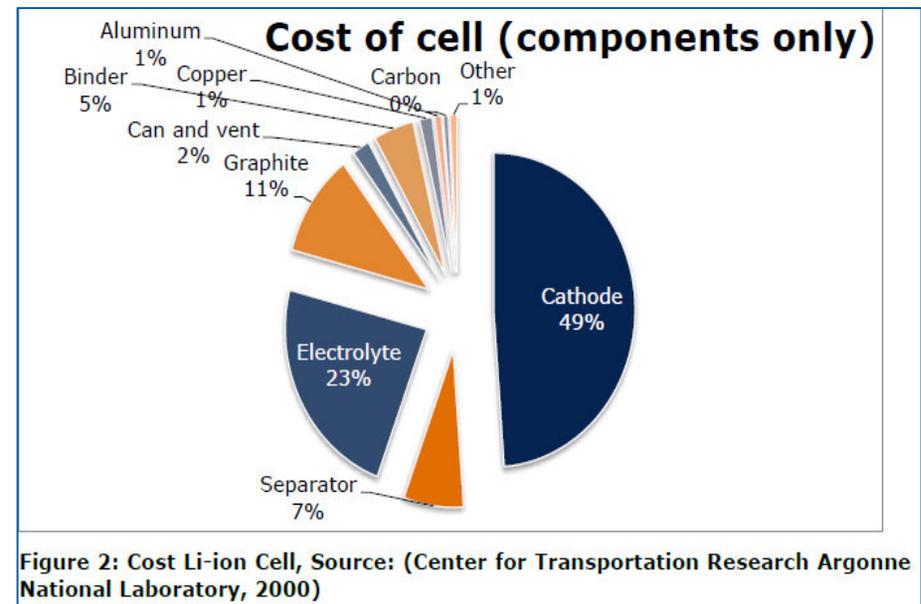
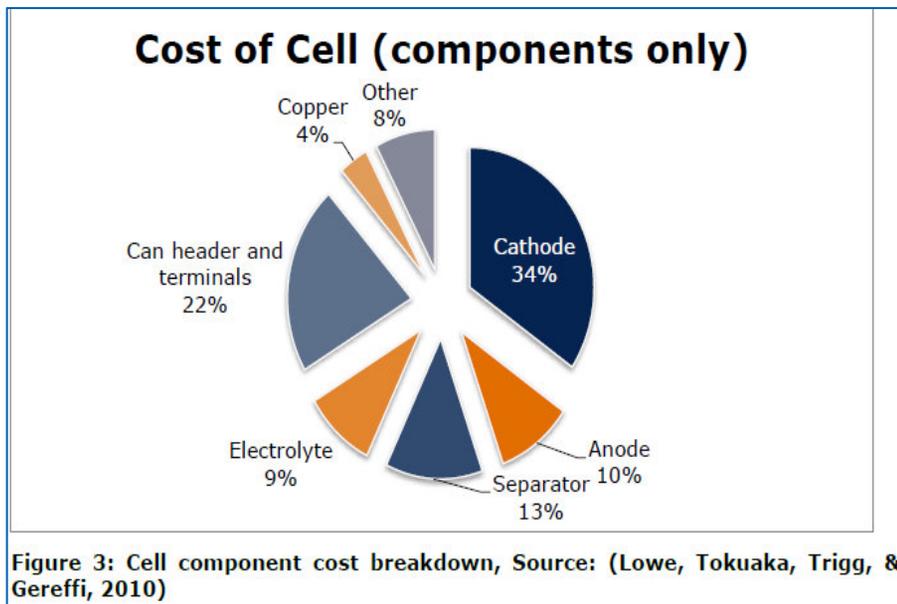
- Open Circuit voltage of  $\sim 4V$
- Specific Energy between 100Wh/kg and 150Wh/kg

Most likely chemistries	Advantages	Disadvantages
<b>Lithium nickel, cobalt and aluminium (NCA)</b>	<ul style="list-style-type: none"> <li>✓ Market ready</li> <li>✓ Energy density, cycle stability and cold start</li> </ul>	<ul style="list-style-type: none"> <li>✗ High cost</li> </ul>
<b>Lithium nickel, cobalt and manganese (NCM)</b>	<ul style="list-style-type: none"> <li>✓ Market ready</li> <li>✓ Energy density, cycle stability and cold start</li> </ul>	<ul style="list-style-type: none"> <li>✗ High cost</li> </ul>
<b>Lithium manganese spinel (LMS)</b>	<ul style="list-style-type: none"> <li>✓ Comparatively low cost</li> <li>✓ Safety performance</li> </ul>	<ul style="list-style-type: none"> <li>✗ Lack of thermal stability of cathode material</li> </ul>
<b>Lithium iron phosphate (LFP)</b>	<ul style="list-style-type: none"> <li>✓ Improved cycle stability (longer life)</li> <li>✓ Low cost</li> </ul>	<ul style="list-style-type: none"> <li>✗ Only recent developments overcome cold start and high temperature aging</li> </ul>
<b>Lithium titanate (LTO) and Manganese spinel (MNS and MS).</b>	<ul style="list-style-type: none"> <li>✓ Particularly strong cycle stability</li> <li>✓ Excellent safety characteristics</li> <li>✓ Suitable for fast charging</li> </ul>	<ul style="list-style-type: none"> <li>✗ Lower cell voltage</li> <li>✗ Reduced capacity</li> <li>✗ Emerging chemistry</li> </ul>

# EV Battery Technology

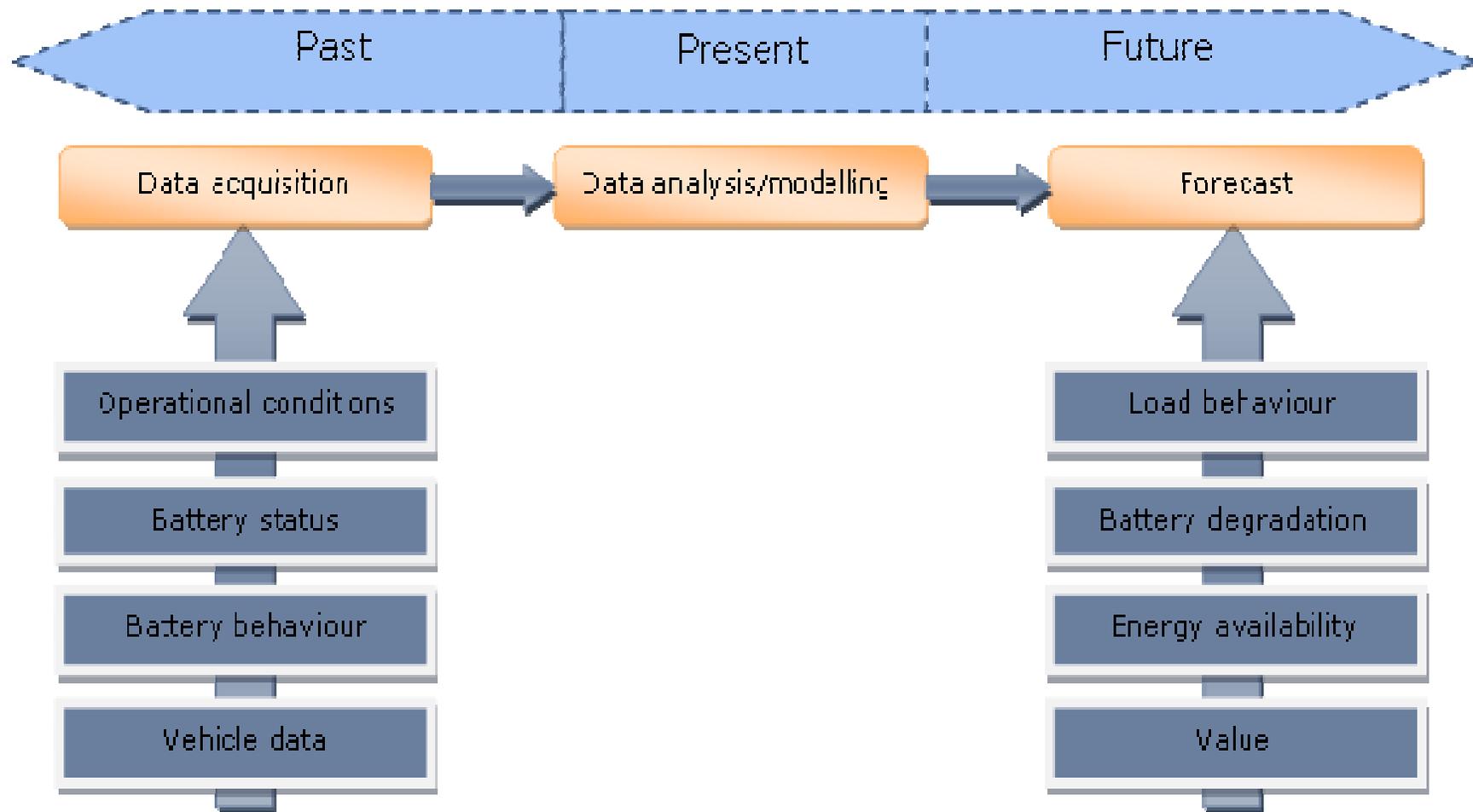
## Cost

- Cost estimates range between £450-1000 per kWh at present
- For scaled production (>100,000 cells per year), costs in 2011/2012 are expected to be around the £320 per kWh mark
- Projected to be as low as £160 per kWh by 2020



# EV Battery Technology

## Tracking and monitoring



# EV Battery Technology

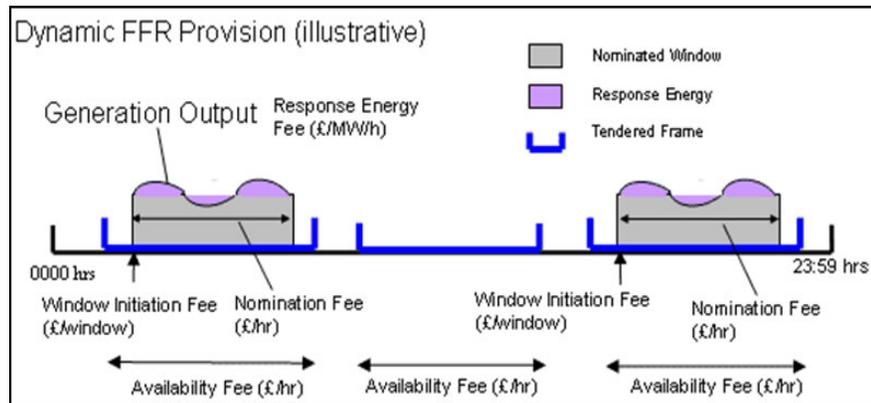
## Use in the energy industry

- Possible reuse scenarios include:
  - Investment deferral for DNOs
  - Use of batteries with renewables in commercial (light industrial) premises
  - Firm Frequency response (FFR)
  - Fast reserve (FR).
- Consortium developed a model / tool that can be used to estimate technical feasibility and Net Present Value
  - Very high NPV – based on current value of service.

# EV Battery Technology

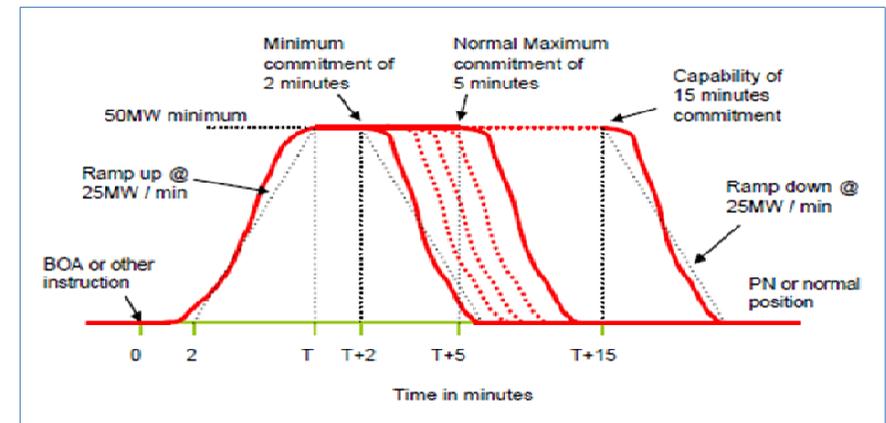
## Use in the energy industry

### ■ FFR

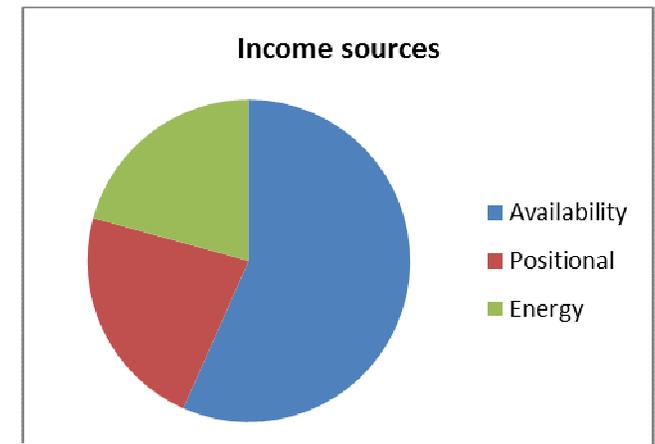
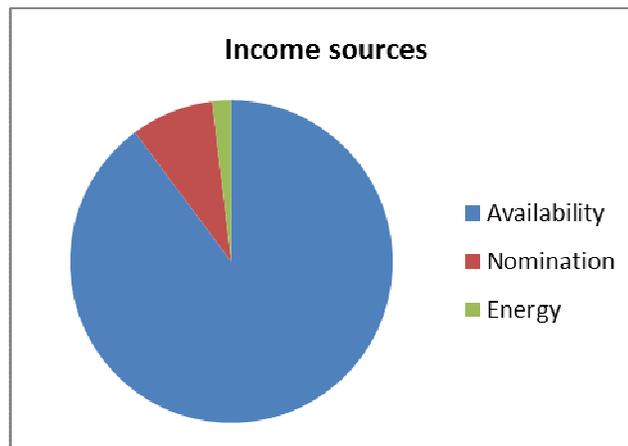


Source: National Grid

### ■ FR



Source: National Grid



# Thank you

Denis Naberezhnykh  
TRL, Senior ITS Consultant  
Tel: 01344770689  
Email: [dnaberezhnykh@trl.co.uk](mailto:dnaberezhnykh@trl.co.uk)

