

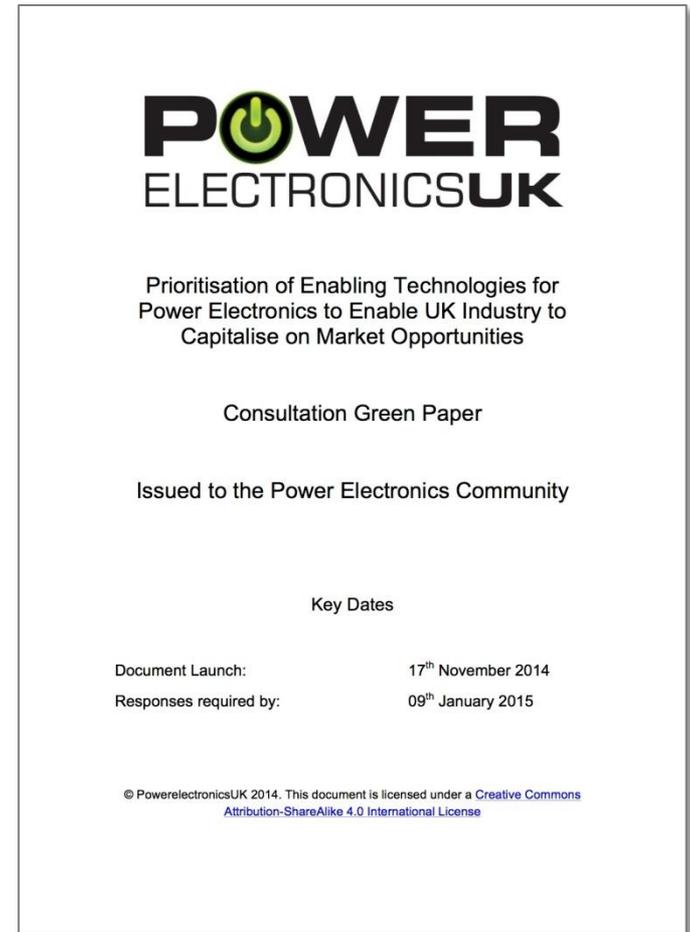
# Technology Working Group Green to White Paper Transition Update

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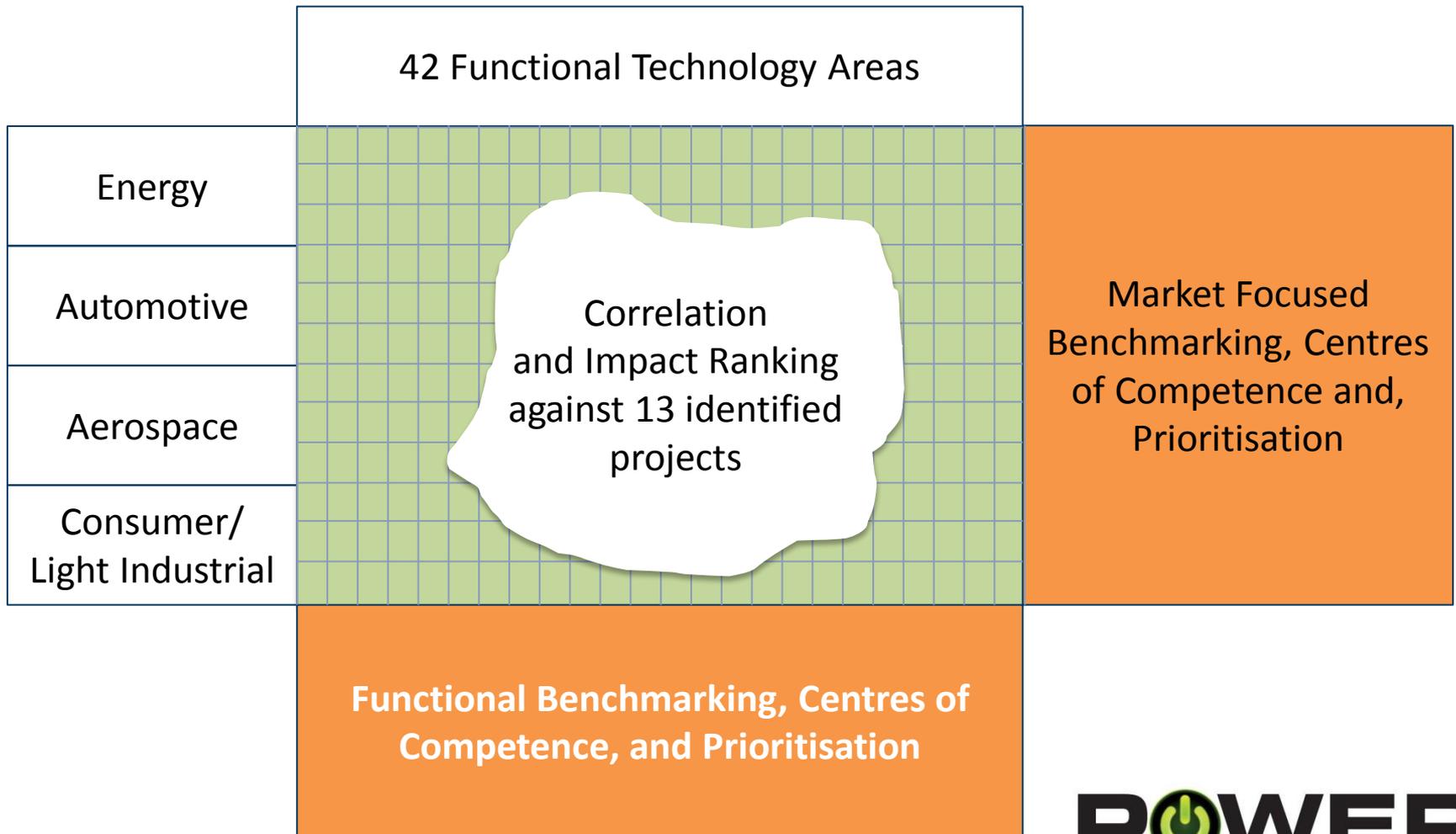


# Progress to Date

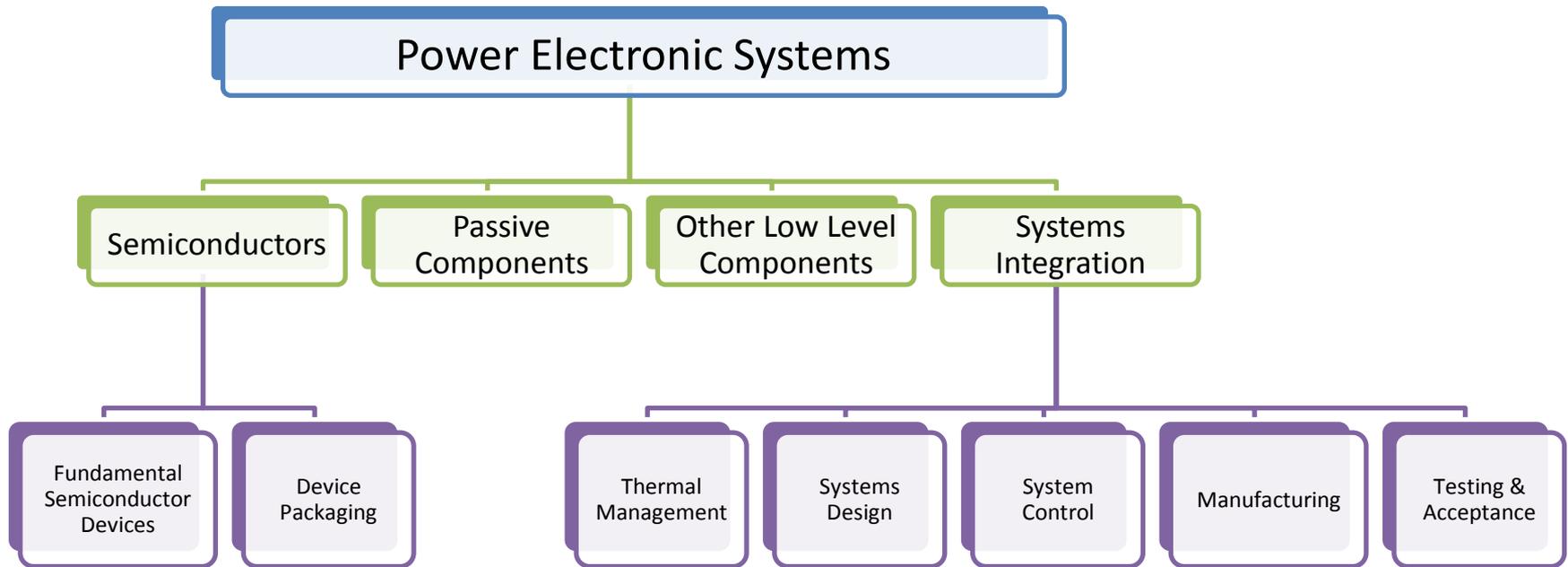
- Green paper issued: 17<sup>th</sup> November 2014
- ~120 downloads, 26 formal submitted responses
- Invited workshop held on 2<sup>nd</sup> July to discuss initial findings
- Feedback conditionally supportive of findings and priorities
- White paper in preparation – timing of launch still under review



# A Data Gathering Technique Was Required – QFD Was Chosen



# We've Identified 42 Technology Areas That Are Critical To Power Electronics



# The 13 “Go To The Moon” Technology Projects Chosen As A Focus to Prioritise Technology Challenges



- Advanced HVDC
- Advanced Industrial Drive
- Intelligent Distribution Transformer
- Smart Micro-Generator Interface



- Integrated Traction Drive
- Wireless Battery Charger
- Supercap bi-directional converter



- Primary power distribution unit
- High temp power control
- Power take-off converter



- Intelligent lighting driver
- Embeddable domestic machine drive
- Integrated battery energy management



# Overall Top 10 Technology Priority Areas

+ Don't forget advanced manufacturing!



Energy



Automotive & Transport



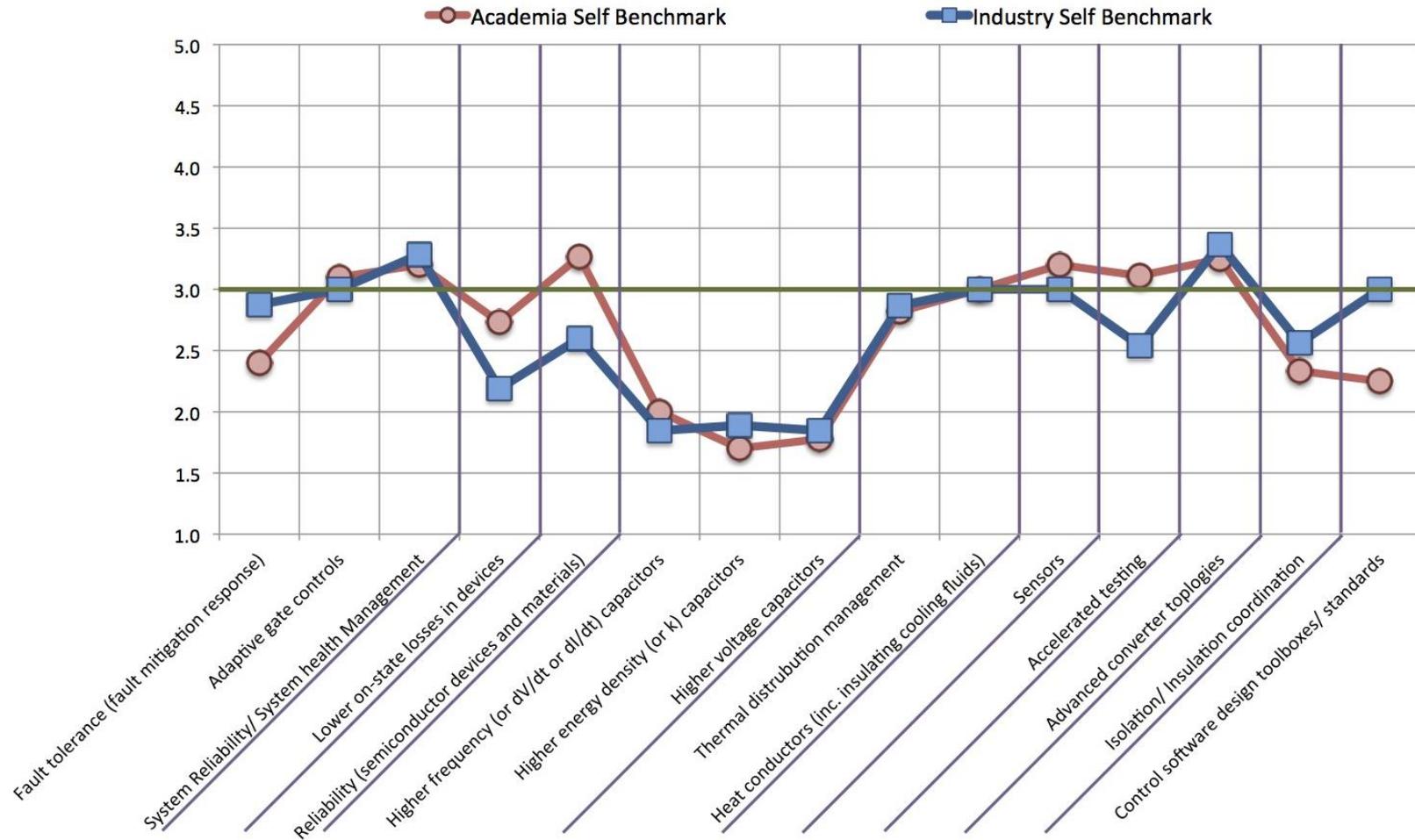
Aerospace



Consumer

1	Fault tolerance and system reliability	●	●	●	●
2	Lower loss power semiconductors	●	●	●	●
3	Component reliability	●	●		
4	Higher performance passive components	●	●	●	●
5	Thermal management	●	●	●	●
6	Sensors	●	●		
7	Accelerated testing		●	●	●
8	Advanced converter topologies	●	●	●	
9	Electrical insulation coordination and isolation technologies			●	●
10	Control software design toolboxes and standards	●	●	●	

# Benchmark of Top 10 Technology Priorities



Finding 1: While the UK Power Electronics Industry has a Robust Supply Chain There is a Perception That it Has More Strength in Depth at the Systems Integration Level Rather than at Component Level.



### *Feedback summary:*

- *Systems have perceived higher added value but a stronger local (i.e. UK) upstream supply chain could lead to greater pro-active development leading to disruptive world leading products*
- *What constitutes a balanced supply chain? Depth of manufacturing or, pockets of world-class excellence? – Answer both, but knowledge more important!*

## Finding 2: Passive Components Urgently Need Innovation



*Based on feedback:*

- *Passives emerging bottleneck driven by advances in WBG semiconductors (is this chicken and egg?)*
- *Emphasis has to be on development of new dielectric (and possibly magnetic) materials & packaging for higher temperature, frequency and voltage*
- *Can the UK really make a mark here? Yes especially if academia can increase focus and we find a way of translating this to industry*

Finding 3: For Other Low Level But Key Components and Technologies in PE Systems – Collaboration with Other Supply Chains (both Upstream and Downstream) is Required Rather than Unilateral Focused Effort



*Based on feedback:*

- *Yes collaboration required - KTN's and/ or trade bodies need to promote awareness of SotA and setting up events to drive cross-sector collaboration e.g. with RF industry.*
- *Need to drive greater linkages with existing catapults to get PE applications into their foci*

Finding 4: Advances in Semiconductors are Essential, But the UK Needs to Focus on High Value Cutting Edge Technologies Where It Can Make a Bigger Impact In The Area



*Based on feedback:*

- *High temperature control and high voltage electronic devices areas where support may yield best yield for UK investment*
- *A WBG catapult with fab capabilities (TRL 3 to 6) would be part of the Big Ask – but needs to be virtual to address GaN, SiC and diamond and support other sectors looking to apply WBG in their application?*
- *Challenge is how to ensure technology investment in this area leads to investment/ jobs in the UK.*

## Finding 5: Systems and Enabling Low Level Technologies to Improve Reliability and Availability are Key



*Based on feedback:*

- *Focus needs to be on reliability of technologies in the TRL 5-7 range i.e. closer to market*
- *Systems Catapult backed by universities could have major role here*
- *Some sectors e.g. automotive may have something to teach*
- *Creation of benchmarks based on operative data would be helpful here – but unlikely to happen*
- *The supply chain needs to take a more balanced proactive approach to risk share*

Finding 6: While There May Be Specific Needs for Advanced Transformative Manufacturing, It is Not Seen as a Major Issue for the Power Electronics Industry, However Greater Proliferation of Advanced Skills May be More the Issue



*Based on feedback:*

- *PE sector needs to work on making itself more attractive to people – e.g.*
  - *create a specific government defined apprenticeship scheme*
  - *Re-opening case for a dedicated centre for doctoral training also should be pushed*
- *For new technologies manufacturing readiness is a big issue – could be part of Big Ask?*
- *PE-UK should take a bigger role in driving UK participation in standards development*
- *Several opportunities:*
  - *Lean manufacture*
  - *Greater integration at systems and sub-systems level*
  - *3D printing for smaller production volumes and accelerated demonstrator development*

## Finding 7: Accelerated Testing is Essential To Ensuring Early Technology Adoption, But Cross Sector Validation Is Perceived to Have Limited Value



### *Based on feedback:*

- *Sectors heavily siloed in approaches to testing – flexible dedicated centre could be useful to SME's but could investment be cost justified?*
- *Big data is a non-starter – just too much commercial sensitivity however useful it may prove to be*
- *e.g. with reliability modelling which would greatly benefit from access to benchmarkable performance data*

Finding 8: There is a Conflict of Goals Between Systems Integrators and Component Technology Providers That Slows the Development and Adoption of Technology



*Based on feedback:*

- *Yes there is. Systems integrators reluctant to reach down into the supply chain to support component development*
- *Protraction of time to market is damaging to SME's.*
- *Both systems and component developers need to invest in R&D to deliver/ integrate new technology – this requires longer term programmes that give certainty to all participants*

Finding 9: Energy and Aerospace Appear to be the Sectors in which the UK Power Electronics Community Can Make Its Biggest Global Technological Impact (but New Innovations May Change This)



*Based on feedback:*

- *Not enough market benchmarking to assert this? Can we do something to address?*
- *Automotive may be fastest pull through for many PE innovations*
- *Industrial drives and traction need to be addressed by the study*

## Finding 10: Industry's Perception of Academia is Good, while Academia Has a Less Rosy View of Industry



*Based on feedback:*

- *RAE/ REF operates creates an automatic conflict of objectives – need to work with other bodies to address this?*
- *No mechanism to link-up InnovateUK and EPSRC projects – can this addressed by stretch goal projects?*
- *Is there a need to encourage more networking between industry and academia? Who should lead this?*

# Finding 11 - Overall the UK perceives itself as a Middle Ranking Global Competitor With Pockets of World Leadership in Some Technologies



*Based on feedback:*

- *Would it possible to run the benchmark for other countries?*

*Top key actions:*

- *Establishment of longer term joined up programmes (e.g. DARPA grand challenges or more stretch versions of Go to the Moon Projects) (7)*
- *Closer collaboration within the supply chain (e.g. sharing of best practice) (6)*
- *More focused calls from InnovateUK (and EPSRC) (5)*
- *Creation of centre(s) to establish focal point (4)*
- *Development of skills (4)*
- *Creation of a joint industry plan (3)*
- *Reinforce upstream supply chain (2)*
- *Increase awareness of PE and promote within education (2)*
- *Focus on systems integration (make UK intelligent global) purchaser (2)*

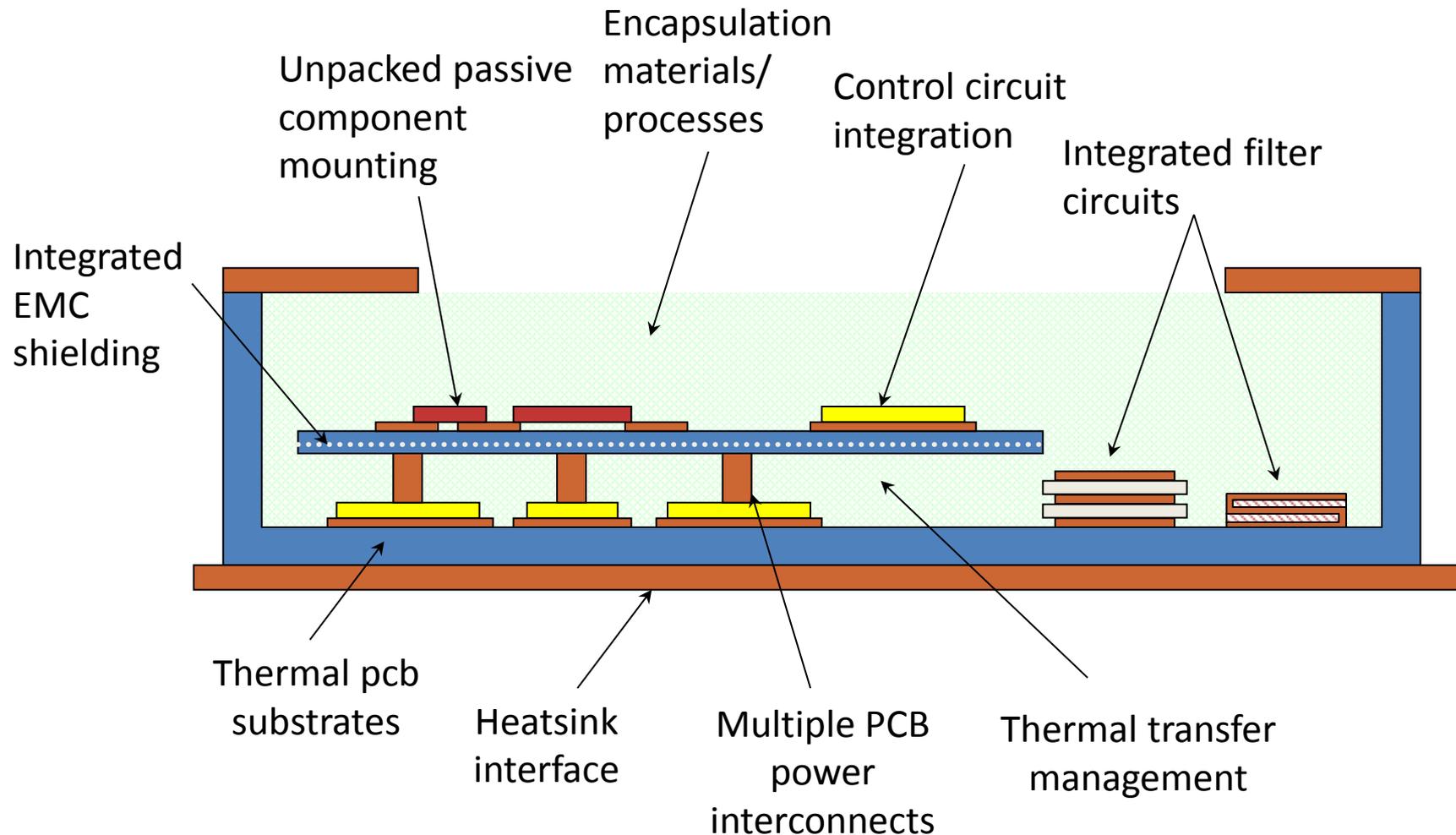
Finding 12: The 13 “Go to the Moon” Projects while a Useful Focus Tool Have Limited Crossover Across Sectors (and don’t address all the issues).



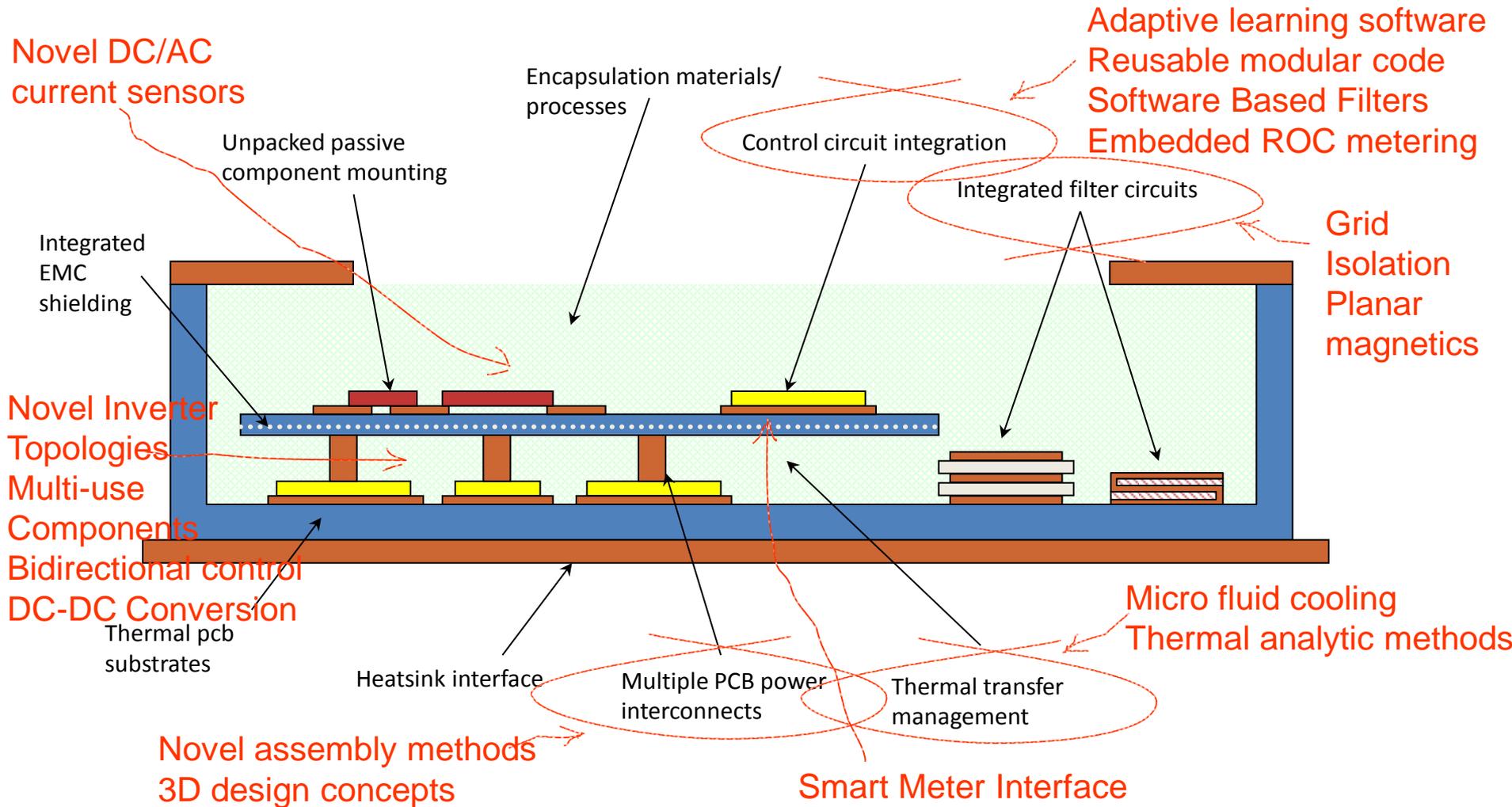
*Based on feedback:*

- *Structured projects that provide a basis for bring industry and academics together would be useful*
- *Are some sectors already going it alone (e.g. automotive and aerospace?)*
- *Can 4-10 stretch projects with cross sector relevance be defined as a UK plc activity either with more ambition than EU programmes or complimentary to them?*

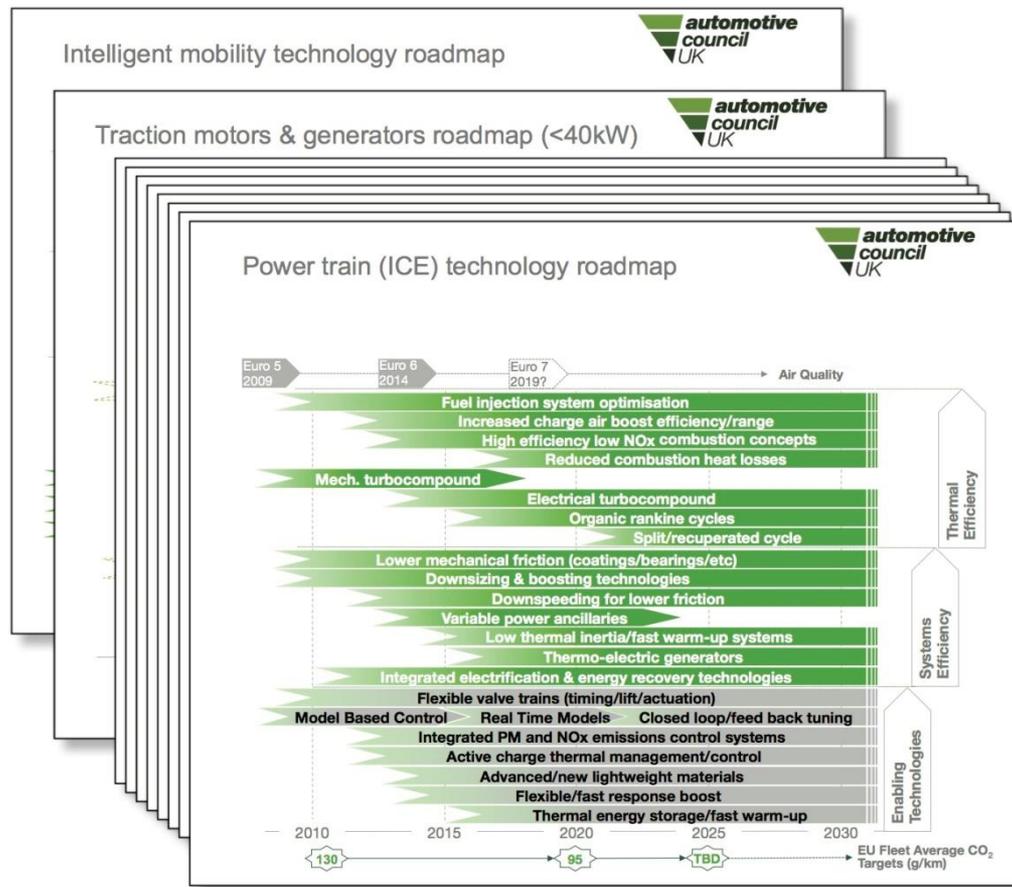
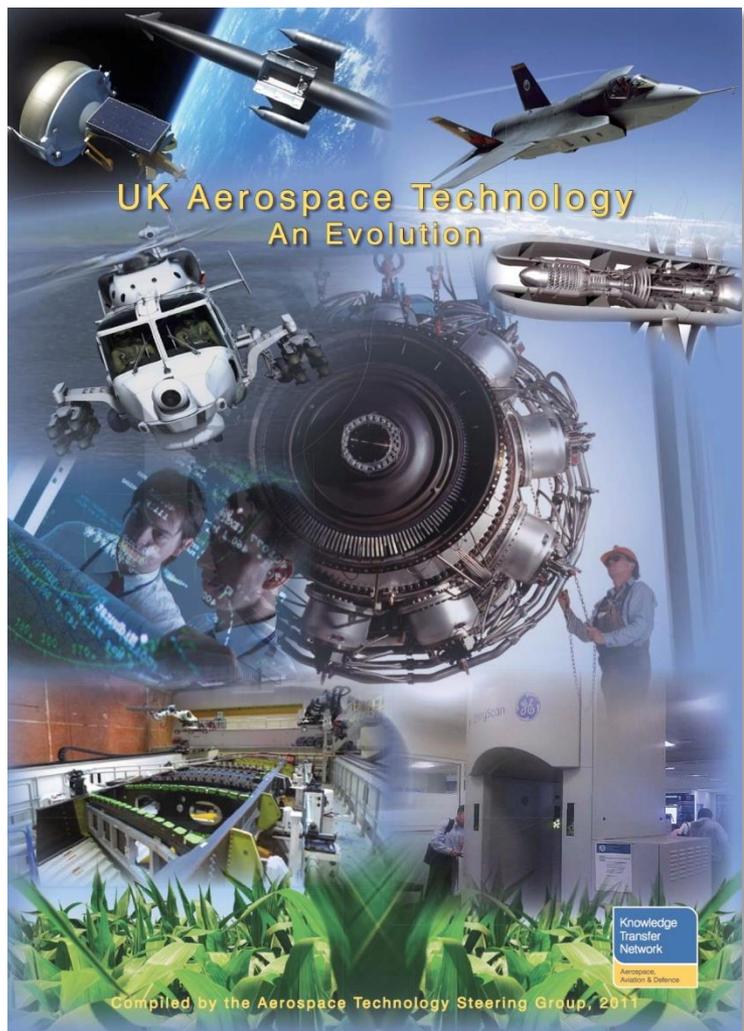
# 2kW Microgen Development Challenge



# Microgen Challenge Area



# Some Industries Are Better Than Others At Collaborating



Overall: The technology strategy exercise and methodology have led to a valid set of conclusions



*Based on feedback:*

- *Would be stronger if we could expand cross-section of input, and address non-covered sectors such industrial/drives, non-automotive traction*
- *Good methodology – but functional definitions may need to be revisited (e.g. where modelling/simulation fits in)*
- *Repeat every 2-3 years*

# The BIG ASK

- Creation of Virtual PE Systems Catapult
- One of major focal area of WBG Catapult
- PE skills development
  - Government approved apprenticeship
  - Centre for doctoral training
- PE thematic programmes in existing catapults  
e.g. transformative manufacturing

# Possible Focus Remit Areas for PE Systems Catapult

