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## Cambridge Cleantech response to the Industrial Strategy Green Paper

### Executive Summary and Recommendations

Cleantech businesses can be the backbone of a **UK revival in world-leading innovation** as they are all focused on problems which apply globally and, in some parts of cleantech, in which the UK has and can maintain a real leading edge and can add significantly to economic success.

These innovations mainly target cost savings, efficiency gains or healthier living and are **future-proofed**, as the risks of climate and other serious environmental problems increase and cost more. Such a focus on engaging with and fostering wider uptake of 'cleantech' innovations would be **nationwide**, improving living standards across the whole country and increasing employment, exports and contributing widely to **productivity gains**.

Key comments and suggestions from Cambridge Cleantech ("CC") for the new Industrial strategy are:

- We recognise and applaud the focus in the Green Paper on innovations in energy storage and low carbon vehicles but feel strongly that microgrids, the circular economy including energy from waste and smart / low carbon buildings should also be added as focus sectors.
- If a greater focus on innovative technologies and the cleantech disciplines is to succeed, then we need to provide the training courses for this workforce of the future. The apprenticeship levy should also have greater in-built flexibilities to allow technology companies to spend more than 10% of their levy on training for companies in their supply chain.
- Incorporating sustainability requirements into new public sector infrastructure contracts could provide a boost to the cleantech sector and the UK economy – for example, sustainability requirements could be built into the HS2 contract creating a boost for cleantech sector innovators. To enable an uplift in housing, support should also be provided to enable SME builders to secure funding more easily.
- Government funding for innovative SME's should continue to be made available through agencies such as the Innovate UK and the Catapult Centres and Government should also instigate a task force of civil servants and financiers to explore mechanisms and policies needed to encourage longer term private sector funding. CC would be delighted to participate.
- The SBRI should be re-launched and the Government should consider support for a new project based on the CC programmes like 'Scale Up' through which innovation-hungry corporates meet with cleantech innovators.

- Support should be provided through DIT for cleantech SME's to undertake outbound missions to priority markets.

Cambridge Cleantech\* applauds the initiative which proposes greater government selectivity of those parts of the economy which are UK strengths and can be world-beating and internationally competitive over time. However, the Green Paper fails sufficiently to recognise **the win-win** which might be accomplished by higher focus on supporting those innovative and valuable businesses across the 'cleantech'\*\* sector which can deliver commercially valuable global improvements in energy efficiency/storage, in materials re-use and recovery, in lower-carbon transport, in cleaner air and water, in enhancements for agricultural efficiency, cost savings in healthcare and more. These future-focused businesses can be the backbone of a **UK revival in world-leading innovation** as they are all focused on problems which apply globally and, in some parts of cleantech where the UK has and can maintain a real technical and commercial advantage, will add significantly to economic success.

A future economy in which cleantech innovations, whether from HE institutions or more commonly from the diverse private sector, are fully adopted and deployed by the public sector (using the new focus on procurement) and by businesses and the public at large (driven in part by regulations set by government) would be both a **more financially successful** economy – these innovations mainly target cost savings, efficiency gains or healthier living – and a **future-proofed** economy – as the risks of climate and other serious environmental problems increase and cost more. Of course, such a focus on engaging with and fostering wider uptake of cleantech innovations would indeed be a **nationwide** endeavour, improving living standards across the whole country and increasing employment and exports. And arguably the adoption of cleantech innovation would contribute widely to **productivity gains**.

Of the 10 Strategic Pillars identified in the Green Paper, it is clear that the **cleantech economy** has a central role for and/or is affected by all:

- *Science, research and innovation* are key, as all the cleantech businesses represented by CC are based to some extent on innovation – usually the cleaner newer solution is a replacement for a higher carbon or otherwise less clean historic solution and must displace the established technology in order to succeed; the fact that renewables are now able to generate 25% or more of UK power needs indicates this is no longer trivial
- *Skills* are the backbone of any growth business; training for the newer technologies' deployment and maintenance is so far lacking at scale and will become increasingly necessary
- *Upgrading infrastructure* is obviously best done in such a way as to **embed future technologies** and requirements during design and implementation – low-carbon cements, sensors and alternative power controls, heat management, digital integration of 5G, water quality monitoring are all examples of cleantech innovation which should be considered with any of the major infrastructure projects under consideration

- *Supporting businesses to grow* is the very heart of the role of CC; we provide a range of growth-oriented support, linking supply chains, sharing experiences and accessing finance etc; to achieve a cleantech-centric future, this is absolutely key.
- *Improving procurement* is an excellent way of enabling the smaller innovative cleantech providers with “tomorrow’s solutions today” to grow; selling to a customer such as the public sector is far preferable to selling equity to a financial “investor” who only wants to exit later!
- *Encouraging Trade and Investment* is also at the core of growing our cleantech businesses. They are almost all, as noted, natural exporters and the solutions they are commercialising are by definition global. Inward investment has already started as the rest of the world recognises the excellence of UK cleantech innovation and our market e.g. renewables.
- *Delivering affordable energy and clean growth* is of course almost synonymous with supporting the cleantech economy; while there are parts of cleantech beyond energy generation, clean growth is universally applicable to the sector and to CC’s members
- *Cultivating world-leading sectors* is absolutely core to our vision; the “win-win” noted above is based on the fact that, in many parts of the cleantech arena, UK businesses are or are becoming world-leaders
- *Driving Growth across the country* is wholly compatible with the notion that, if a business has a solution, it will be applicable across the world and therefore nationwide. Cleaner air and water, lower cost power and heat, better transport and other cleantech business opportunities are axiomatically ubiquitous and relevant everywhere. Additionally, there is almost no “singular centre” of cleantech innovation and commercialisation activity in the UK; Cambridge and the region may have a higher concentration than some other areas but it is true that every corner of the country has some cleantech growth
- *Creating the right institutions* is vital for the cleantech world as so much of the ‘licence to operate’ in this sector is governed by regulation and legislation. Compliance with UK (or sometimes EU or other) standards drives much of the innovation in the cleantech world. There is also a role for seeking to influence regulations where science or experience indicates that the regulatory framework is not functioning as it should or is not up to date.

### **Specific observations and comments**

CC recognises and applauds the focus in the Green Paper on innovations in energy storage, as a major key to the further deployment of renewable energies – Sir Mark Walport’s review of battery technology, energy storage and grid technology will be very important. Several of CC’s members are leading players in the development of innovative energy storage ideas and others are involved with proposals to improve the grid – be it by greater digital oversight and control or by enabling distributed energy micro-grids with DC power from solar for DC uses (EV, computing, LEDs, most electric motors etc).

The future automotive sector, also featured in the Green Paper, is another area in which CC members are active, from fuel cell and hydrogen, lightweighting to new electric vehicles, charging technologies and the roll-out and automated monitoring of EV fleets. It is clear that, in a modern economy, reliance on the hydrocarbon engines of the 20<sup>th</sup> century will not be sustainable, so working with various alternatives on the pathway to lower carbon transport is a core part of the cleantech activity set.

CC feels strongly that other areas in which the UK has a critical mass and expertise should also be included as focus sectors in the industrial strategy, including microgrids, energy from waste and smart buildings.

### **“Whole country”**

While the Paper is clear it wants to address the disparities across geography in the UK, reducing a bias in economic GVA in the South East, a message from the cleantech economy is that many good solutions truly can be adopted **everywhere**. A recent joint trial with DEFRA with one of CC’s members into the public’s attitude to segregation of waste, in 3 completely different regions, gave a varied response to education about separating out another waste stream (plastic laminates in food packing etc) from which aluminium can be recovered by a CC member’s technology. Once the public had been alerted they were willing to separate the relevant items for recycling, in each of the 3 different regions, but at rates between 10% and 45%. While this illustrates that the country is not uniform, the opportunity for the trial was clearly relevant in each area, and throughout the country.

On the other hand, it must also be noted that the geography of the UK is itself a kind of “pillar” that cannot be ignored; I refer not to economic variations but in terms of sea level, solar gain, wind speeds, flood risk etc. Water quality and the need for treatment varies at least in part due to geology; rivers’ flood risks are related to proximity to higher ground; agricultural variation from pastoral/arable to hill farming will inevitably impact on some renewable energy opportunities as well as run-off pollution risks. Historic road and rail networks are not evenly spaced post-Beeching and certainly London-centric. While these features may not be easily amenable to policy correction it is unreasonable to pretend all regions are physically equal by diktat. For some technologies investing in core solutions will simply be more economically viable in some areas more than others.

### **Productivity and Wage Levels**

It is economic wisdom that increasing productivity will lead to higher earnings by allowing more value add per worker. Ignoring the apparent assumptions about the distribution of increased value-add between labour and capital, it is not always true that efficiency gains lead to desired outcomes. Robotics, automation, increased IT

control, AI and machine learning may all be the next generation of productivity gains, as mechanisation per se was in earlier decades. While these will probably all tend to improve value add, on international comparisons if the UK invests more than other countries, it is not apparent this will automatically increase wage levels, living standards or even employment.

## **Innovation**

With regard to the cleantech economy, it is certainly true that there is NO LACK of innovation; the UK does not need policies to unleash or incentivise more innovation. Certainly from the perspective of CC, there is an abundance of innovative ideas and entrepreneurs willing to take risk to seek to convert good ideas into viable businesses. It was possibly a false assumption of the “noughties” that the UK needed to unlock more innovation, leading to hopes that Universities, if ‘encouraged’ with tech transfer, Challenge Funds and the like, would produce more commercialisable innovation. This was possibly only partially successful.

Much more of the innovation economy is beyond Universities and there is no shortage of new STEM ideas, certainly in the cleantech sector, or other ways to challenge existing service and market practices with new business models as well as new technology. While some is in large corporates, much is at SME and start-up level, as evidenced by the membership of CC. This has then shown up the next national challenge, how to take possibly global innovative SMEs and help them “scale up” to their full potential.

The ‘lack’ then and now was not a shortage of ideas or initiative but **efficient intermediation between good ideas and the people and money to grow them into businesses**. The Paper correctly identifies “patient capital” as a problem (see below) but this is not the whole issue. Recognising that there are many ideas, that not all can succeed, identifying what distinguishes those which commercialise from those which may never, understanding the (long) time it takes to take an innovation and succeed as a business are all entirely true of the cleantech economy as of other parts of the innovation entrepreneurial world. A shortage of initiation of this entrepreneurial activity is the least of our problems.

## **Skills**

For most of the new cleantech industries – low carbon vehicles, energy efficient construction, renewable energy generation, grid management – there is only very limited established specialist training in place and very little senior management sector experience to pass on to new companies. There are very few UTC or other specialist training facilities focused on new high-employment sub-sectors – PV installation and maintenance, smart meters, energy efficient house building, the growing need for maintenance of Electric Vehicles and charging points – but if the win-win economy

including a higher focus on the cleantech disciplines is to succeed, some further thought will be needed on training the workforce of the future in these matters.

While much of technology underpinning 'cleantech' is the core STEM disciplines and skills, so the proposed improvements in STEM per se will support cleantech businesses, there are certain variations to upskill from e.g. basic electricians to advanced photovoltaics, from basic construction skills to the extreme care needed to achieve low energy passivHaus or similar quality, interdisciplinary abilities for designing lighting quality in horticultural, agricultural or hydroponic food contexts. There are then training needs for those who will be able to advise on compliance with the diverse regulatory requirements which permeate almost all cleantech activities, for which this is at present only limited HE or other support. Consideration might be given to an **audit of the various local and disparate cleantech training faculties** across the country, to better coordinate them and perhaps develop **qualifications more specific to cleantech sub-sectors** to recognise skill progression.

From experience in working with hi-tech companies, CC also suggests that the apprenticeship levy should also have greater in-built flexibilities to allow technology companies to spend more than 10% of their levy on training for companies their supply chain.

### **Upgrading Infrastructure**

The major infrastructure projects referenced in the Paper all involve enormous amounts of engineering and construction. The objective will surely be to embed into these major projects as much as possible to "future-proof" them for the next 50 years, as they will endure that long at least. CC would hope that the procurement procedures for these major construction and other projects, including nuclear, rail, road, water, ports, grid, fibre-optics etc are ALL conducted after a careful review of **innovative products and solutions** that might reduce their carbon content, increase their sustainability and longevity, minimise other environmental consequences etc. For example, a CC member produces Cemfree which is concrete with NO cement and therefore hugely less carbon intensive; another member manufactures formaldehyde-free adhesive from bio-material which is used to bond a fibreboard instead of traditional MDF for concrete shuttering; a third company has developed an additive for any plastic which makes it biodegradable. Adoption of products such as these, at scale, in the infrastructure programme would both build these businesses but more importantly embed sustainable innovations into the major projects, with no cost disadvantage. The integration of renewable generation into some of the sites for infrastructure development (e.g. wind turbines along railway lines?) might also be reviewed.

Incorporating sustainability requirements into new public sector infrastructure contracts could provide a boost to the cleantech sector and the UK economy – for

example, sustainability requirements could be built into the HS2 contract creating a boost for cleantech sector innovators.

To enable an uplift in housing, support should also be provided to enable SME builders to secure funding more easily.

### **Supporting Businesses to start and grow**

As noted above, the policies of successive governments have not adequately stimulated the private funding market to provide the necessary support for many innovative companies to start and scale; arguably less than other nations have, giving the UK a competitive disadvantage? While some policies – SEIS, EIS, R&D Tax credits – have been extremely valuable to unlock incremental private capital and assist early stage cash flow, the grants and business support systems available in the UK (both UK and EU) have been insufficient, notably because

- “match funding” is almost impossible to access for a pre-revenue innovator, as the banks are disinterested in their risk category and private capital is not unlimited in supply.
- Retrospective repayment of monies spent is often an insuperable problem if the company has insufficient funds to carry over working capital during the interim
- The implicit assumption in support policies (coded “market failure”) seems to be that it takes only some 2-3 years to develop a technical concept from ‘lab’ to market. The experience of CC members is that this is often a significant under-estimate and that, partly because innovation itself is not a perfect process, partly because, to get to market, evidence, proof, qualifications and standards must be achieved (CE mark or equivalent) and often because there is entrenched resistance in established customer businesses, even those innovations with clear cost benefits as well as efficiency or other advantages may take >5 years to be market ready and post-revenue.
- UK customers, whether ‘the public’ or corporate B2B buyers, are initially slow to adopt new ideas, possibly risk-averse and conservative. Where major demand shifts have taken place (seat belts, smoking, PV solar) they have seemed to require a significant unambiguous government lead. If we are to move the needle with regard to reducing energy usage, improving waste recovery/re-use/recycling or a switch to lower-carbon transport it seems

inevitable that these will also require MAJOR government lead. Once a switch is made, the economic benefits and quality of life benefits are enormous so it should be a serious consideration of policy-makers whether, for some of the cleantech economy, a more substantial business growth support initiative could be undertaken, building **demand** for innovative solutions now available. A shift into revenue-generation is the absolute marker of a growing innovative business.

- Lastly, the basic tax system in the UK significantly influences private investors’ preference for a capital gain = exit as the way to seek remuneration. With Capital Gains tax set at most 28%, (18% for lower income investors and entrepreneurs’ relief

for holders of 5% or more of the equity reducing this to 10%), in contrast to marginal income tax above 40%, it is not hard to see why “exit via sale” with a capital gain is the now ubiquitous logic of private investors. Building a business and taking a dividend income is simply not attractive except to the longest-term, most patient investors! This has to be recognised when setting policies to encourage the commercialisation of innovation.

As noted in Greg Clark’s letter, “we have had a weaker record in translating discoveries into new businesses.....many growing businesses report that they struggle to access patient capital”. This is indeed very accurate but words missing from this description are “**risk**” and “**time**”. Significant reasons why private capital is less enthusiastic to invest in innovative growing companies, including at the moment cleantech companies, are the perception of the risk of frequent changes in regulatory frameworks (almost all energy support and other environmental regimes have changed repeatedly over recent years) and the belief that the time to exit is simply too long.

Government funding for innovative SME’s should continue to be made available through agencies such as the Innovate UK and the Catapult Centres and Government should also instigate a task force of civil servants and financiers to explore mechanisms and policies needed to encourage longer term private sector funding.

**Government procurement** has a really vital role to play here, as does a determination in central government NOT TO CHANGE the **regulatory framework** as often.

For some businesses, with low technology risk but requiring capital for market penetration, a major question is whether financial instruments can be structured so that pension funds and similar can invest, taking a secure long-term income (e.g. like project finance for a city-wide lighting installation or an ESCO/MUSCO) while providing initial capital to enable technology roll-out.

Lastly, while the text-book assumption for financial support for early-stage growing innovative business has been private capital (HNW, angels etc) or, if the company is considerably further along the risk journey, perhaps Venture Capital or VCTs, there is another very relevant but not often cited source of financial and business growth support – the corporate sector. Larger companies in many sectors are able to take an interest in smaller innovative entities, either in a JV, with a joint development agreement or in straight equity, and often these cooperations are mutually beneficial. There is a natural reluctance by many smaller companies of “David and Goliath” and on the other side there is sometimes impatience in the more established corporates with the less organised operations of smaller growth companies. However, the mutual benefit of cooperation can be very valuable. **We propose that the government review of Patient Money should explicitly include studying models of best practice for “big and small”, including a review of appropriate protections and value sharing, to unlock the enormous potential this might represent.**



## **Improving Procurement**

As noted above, this is a very major policy direction with enormously beneficial implications for the growth of the cleantech economy. If at least the public sector were encouraged (or mandated) to preferentially procure with low carbon, energy performance, reduced waste or other environmental criteria as part of the buying decision, rather than just primarily “value” or “cost”, the opportunity for cleantech innovators to apply for sales would increase dramatically. As noted, the regime for procurement may change with less EU determination of UK public practice.

In the few occasions where CC has arranged “meet the buyer” events for public sector organisations (hospitals, Universities, Enterprise Zones etc) the uptake has been less than we would have liked, although in each case we were able to mobilise >30 CC members to apply for the contracts tendered (lighting, low carbon housing, energy efficiency products). SBRI has been an excellent idea but considerably less in use than one might have hoped. David Connell’s review is awaited with interest but a much wider activation across the public sector is to be encouraged. Such “meet the buyer” events are proving successful in providing opportunities for innovative SME’s to secure contracts with corporates – the new pilot between Origami Energy and Anglian Water is a case in point.

The SBRI should be re-launched and the Government should consider support for a new project based on the CC programmes like ‘Scale Up’ through which innovation hungry corporates meet with cleantech innovators.

## **Encouraging Trade and inward Investment**

As mentioned above, all cleantech innovation is by its nature global and therefore exportable. Further, there is evidence that firms from other countries have recognised the UK’s leading position in some sub-sectors of the cleantech economy and are looking to set up operations in the UK or buy into UK companies. In CC we have built strong relations with French companies Bouygues and Engie, we are working with companies who are reviewing options for establishing operations in USA and we have been on several trade missions inter alia to China, India, Germany, Finland and France.

Our membership is alert to the global nature of their innovations and we support them where we can. The cleantech spectrum of businesses are natural leaders for a UK export drive and in some cases already recognised as world leaders in their innovations. Cleantech should therefore be a major part of the government’s plans for building this Pillar. Support should be provided through DIT for cleantech SME’s to undertake outbound missions to priority markets.

## **Delivering Affordable Energy and clean Growth**

As noted, this is the core of the cleantech world as described in this submission. CC would be delighted to discuss in detail with BEIS what we have assembled and learned about innovation and opportunities for spreading them across the country as well as other aspects of building further this core Pillar for the Industrial Strategy.

## **Cultivating World-leading Sectors**

It has been noted several times above that parts of the cleantech economy in the UK are world-leading. The world of photovoltaics, of LEDs, of EVs and lower carbon vehicles, of smart monitors and meters, in some instances of material re-use/recovery, of parts of the agri-bio-solutions (bio-fuels, bio-polymers, wastes from agriculture, water quality), of innovative building and construction materials and processes, of energy storage and grid optimisation and to a lesser extent next generation energy supply are all areas where UK companies and individuals are recognised as world leaders. The cleantech sector in the UK has not yet achieved growth of some of our innovations into the scale achieved by some IT, bio or digital businesses but as a conglomerate of individual related businesses it is arguable the UK has the largest cleantech business community outside the USA.

The last 2 pillars, **Driving Growth across the whole country** and **Creating the right institutions** are more political agenda topics than are relevant for CC to comment on further.

It is not essential, for the arguments in this response to the Green Paper, to document the scale of the existing cleantech economy in the UK, but for the sake of an indication to give weight to the importance of the points noted above, it is estimated that the sale of “environmental goods and services” (a surrogate for cleantech as the SIC codes do not allow a more accurate approximation) is some £50bn pa or 3% of GDP. Jobs across the cleantech sector are higher value than average for the UK, with double the GVA per job and growing. This may not be the most integrated or coherent set of businesses but, when taken together as we do at CC, the cleantech economy is a large, growing, future-proofed and economically important element of the UK.

CC and its membership welcome the Green Paper and look forward to an opportunity to discuss these comments and further assist in finalisation of the proposals it contains.

**Hugh Parnell**

**Chairman, Cambridge Cleantech**

\* Note: Cambridge Cleantech is a 16-year old community of innovative technology-based BUSINESSES working together for mutual support across the range of low carbon, renewable energy and environmental technologies.

\*\* “Cleantech” is an inadequate term as there is in fact **no single technology** which is ‘clean’, in contrast for example to ‘biotech’ where much of the business is centred on genes, DNA and wet biology. ‘Cleantech’ is more akin to “life sciences”, a grouping of businesses across a spread of disparate activities including biotech, pharmaceuticals, medical device etc. In a similar way ‘cleantech’ has become the collective idiom as shorthand for those companies which are deploying innovative technologies in the energy, buildings, transport, materials and environmentally-focused (air, water, soil etc) sectors. Inter alia these innovators are seeking to address global problems – lower carbon for climate change, circular economy for resource depletion and scarcity, new supply side sources of energy generation (power, heat, light) as well as reducing demand for energy wherever possible and inventing storage solutions to better intermediate supply and demand, innovative ways of achieving ‘cleaner’ water, air, soils (merging with agri-tech) for food supplies and healthier living – and are almost all able to commercialise their particular ‘tech’ as businesses because of **regulations** set by national and international governments/agencies. By their nature they are **global** businesses, in the sense that if a solution works in Chelmsford it will likely work in Chittagong and China; often they are IP rich, STEM-based (be it digital/ IT, chemistry, physics, biology, engineering), collectively employ large numbers of workers from basic skills up to the highest trained scientists and will be among those businesses which, for the foreseeable future, **improve the quality of life** (or even enable it to be sustained) and well-being.

Many of these businesses’ innovations are about efficiency improvements – higher energy performance, less material waste, lower cost of measuring and maintaining water quality etc. Some are more simple - finding ways not of doing the same with less but just doing less! Because the range of ‘cleantech’ is wide, these innovative businesses are suppliers to almost all other sectors in the economy or to their customers, such as to the automotive, energy, water, construction, healthcare, chemical, retail, service sector businesses which make up the bulk of the economy. ALL are users or consumers of these cleantech solutions; it is to the advantage of the whole economy that energy efficiency is improved and supply/demand balance enhanced, that material waste is reduced, that buildings quality is improved, air and water pollution diminished, that our cities are “future cities”.

The cleantech sector is thereby an **enabler and enhancer for the future of the entire economy**. The UK already has a core of world-class leading innovation businesses in ‘cleantech’, for which Cambridge Cleantech is a representative voice. Although based in Cambridge, the membership of CC is much more nationwide and indeed international, with members in North America, Europe, Asia and trade visits to >7 countries over the past 5 years. We have >300 full members – from large companies such as Anglian Water Group, Engie, Bouygues, Johnson Matthey to a larger number of, as yet, smaller but growing companies with specialist innovations across the cleantech spectrum.