GREATER BRIGHTON ECONOMIC BOARD	Agenda Item 18

Subject:		**10 Pledges on the Environment Update 2021**
Date of Meeting:		**19th October 2021**
Report of:		**Chair, Greater Brighton Officer Programme Board**
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LA(s) affected:		**All**

FOR GENERAL RELEASE

1. PURPOSE OF REPORT AND POLICY CONTEXT

1.1 The Greater Brighton Economic Board ('the Board') oversaw the development of 10 Pledges on the Environment, which all GBEB members signed up to in October 2020. It was agreed at this meeting to report back on progress made at the October 2021 Greater Brighton Economic Board.

This report gives an update, one year on, on the 10 Pledges. It demonstrates that the Board's commitment to transitioning to a net zero carbon region has helped to drive solid progress on:

- the Sussex Kelp Restoration Project and development of the Sussex Bay initiative to restore nature and enhance the potential of marine and coastal environments to deliver carbon sequestration, biodiversity and other public benefits.
- joint working on high-profile infrastructure including Hydrogen Sussex and the Housing Retrofit Task Force
- members in an improved position to bid for national funding on public sector decarbonisation
- delivery of the first school raingarden (in progress) at Moulsecoomb Primary school through The Aquifer Partnership's 'Rainscape Campaign'.
- South Downs National Park Authority launching 'ReNature' nature recovery campaign.
- adaptive work by water companies to deliver water efficiency messages during Covid when home visits were not possible.

Appendix 1 provides more detail on each Pledge, and **Appendix 2** provides a list of relevant research in the University of Sussex.

1.2 Further work is planned to develop leadership in developing the low-carbon economy and this is noted as 'next steps'.

1.3 The Pledges form the background to the Board's development of a Blue/Green Investment Plan. They contribute to demonstrating that the Greater Brighton area can be an exemplar to government about how to decarbonise a small city, rural communities and coastal areas.

2. RECOMMENDATIONS:

2.1 That the Board notes the progress demonstrated on the 10 Pledges on the Environment since October 2020

2.2 That the Board supports the actions needed to take the Pledges forward in the next year to October 2022.

2.3 That the Board receives a further annual update on the 10 Pledges in autumn 2022.

3. CONTEXT/ BACKGROUND INFORMATION

3.1 The Economic Board oversaw development of GB10 Pledges that sit above the Energy and Water plans. These 10 environmental pledges are approved actions agreed and ratified by the Board in October 2020. The Pledges are a promotional tool which is used to push forward the city region's work towards a post carbon economy through a variety of channels. When they were agreed in 2020, the Board asked to be updated on their progress in 12 months.

3.2 To accompany the pledges a video has been produced to bring the pledges and plans to life.

3.3 The 10 Pledges and the underlying Energy and Water Plans are closely linked to the economic recovery and future prosperity of the City Region.

3.4 The Greater Brighton Economic Board and the Greater Brighton Infrastructure Panel are well established and regionally recognised bodies which offer local leadership on a number of work strands that are pushing the city region towards a low carbon/post carbon economy. The overarching partnerships with local authorities, further and higher education partners, business, economic partnerships provide an effective showcase with insight into a variety of issues.

3.5 The Infrastructure Panel brings together technical experts and infrastructure providers and there is some substantive background work already completed, including **The Greater Brighton Energy and Water Plans** which were developed by the Infrastructure Panel with the aim of unlocking sustainable growth.

3.6 The Energy Plan identifies proposals to accelerate the delivery of energy projects that will boost resilience and security and at the same time help reduce carbon emissions to zero.

3.7 The Water Plan builds on work around the water environment that's already in progress across a number of organisations to set out opportunities to address ongoing challenges in new, innovative ways, yielding much increased benefits

for the local area, compared to current, 'conventional' approaches. The intention is to move new building development towards ‘water neutrality.’

3.8 Substantive next steps are being progressed including:

- **Blue/Green Investment Plan -** an overall strategy and pipeline of projects in readiness to pitch for investment. This Investment Plan will encapsulate all of the work being done at a city region level to move towards a net-zero economy, and the investment – both public and private – necessary to drive that transition. As such, Blue/Green Investment Plan will be the main strategic guide to the future implementation of the GB10 Pledges.
- **Homes Retrofit Task Force** – joining forces to establish good practice and efficiencies in improving social housing energy efficiency
- **Sussex Bay Project and Sussex Kelp Restoration Project** – focusing on mechanisms for blue carbon and blended finance
- **Sussex Kelp Restoration Project** – focus on science and evidence for benefits for carbon and biodiversity
- **Hydrogen Sussex** – developing a hydrogen economy across Greater Brighton
- **Lobbying –** a number of areas are identified where Greater Brighton could lobby to enable and facilitate the environmental pledges:
    - Development of carbon codes beyond current woodland & peatland (including blue carbon)
    - Champion delivery of robust local plan policies that support the restoration of nature (e.g. through delivery of SUDS) in line with current and emerging environmental legislation.
    - Tighter water and energy efficiency standards in new homes and to champion retrofitting
- Audits of corporate and commercial buildings to support programmes of energy efficiency and bidding for funds.

4. ANALYSIS & CONSIDERATION OF ANY ALTERNATIVE OPTIONS

4.1 Prior to COP26, this is a timely update to showcase progress made across the city region on climate action.

4.2 The 10 Pledges have formed an excellent platform for joint work between Greater Brighton members. The ‘next steps’ actions highlight a range of practical actions that GB members individually and together are taking forward.

5. COMMUNITY ENGAGEMENT & CONSULTATION

5.1 None required.

6. CONCLUSION

6.1 The 10 Pledges on the Environment have supported Board members in carrying forward their own actions and targets on climate change. Progress

also demonstrates that Greater Brighton is developing leadership and capacity on a range of climate actions.

7. FINANCIAL & OTHER IMPLICATIONS:

Financial Implications:

7.1 There are no direct financial implications resulting from this report, however, the Board will support future actions needed to take the Pledges forward in the next year should they arise. This may include exploring investment and funding opportunities.

Finance Officer Consulted: Rob Allen *Date: 04/10/21*

Legal Implications:

7.2 There are no legal implications arising directly from this report

Lawyer Consulted: Joanne Dunyaglo *Date: 04/10/21*

SUPPORTING DOCUMENTATION

Appendices:

1. 10 Pledges on the Environment – Update October 2021

2. Developing new solutions for tackling climate change: some examples from University of Sussex

APPENDIX 1 - 10 Pledges on the Environment – Update October 2021

1. **Kelp:** backing a scheme to introduce a carbon capturing kelp forest off the Sussex coast

Key achievements	Sussex Nearshore Trawling Byelaw confirmed & permanent (March 21). Sussex Kelp Restoration Project moving at pace with a focus on science & evidence underpinning benefits (carbon and beyond). Sussex Bay Project moving at pace with a focus on mechanisms for delivering blue carbon and blended finance. Sussex Nature Partnership facilitating a number of projects across GB area focused on nature recovery to deliver multiple benefits
Next steps	GB to use collective voice to push government for carbon codes beyond current woodland & peatland (including blue carbon)

2. **Water Recycling:** partnering projects to introduce recycled water into new homes

Key Achievements	Southern Water/South East Water project exploring water recycling from Peacehaven wastewater treatment works to Barcombe/ Arlington reservoirs. Southern Water progressing strategic solutions in wider region to blend large scale recycled water with raw water to reduce the pressure on sensitive ecological sites (chalk rivers). Crawley Water neutrality study published, that explores how to enable development whilst managing demand for water and environmental impacts. Water recycling forms a part of the package of measures proposed.

3. **Zero Emission Fleets:** committing to phasing out diesel cars, refuse trucks, vans

Arun DC	Expects to have EVCPs at a number of ADC staff buildings installed by April 2022. Once the infrastructure is in place, the Council's fleet will transition to electric vehicles for cars and small vans.
Adur & Worthing Councils	AWC have installed electric vehicle chargers at Commerce Way depot and purchased 3 electric vehicles for council operations, with plans to increase the size of low carbon fleet as further vehicles replaced.

BHCC	A strategy is being developed to transition to a zero-carbon fleet by 2030, replacing vehicles as leases are renewed. Currently 25 vehicles are electric (>5% of the fleet) and the council has just taken delivery of an electric refuse vehicle. The Housing Repairs and Maintenance service have taken on a new fleet which includes some electric vehicles, and EV chargers are installed at the housing centre. Hydrogen options are being considered for larger vehicles such as refuse trucks.
Crawley BC	The Decarbonisation Action Plan in response to the Climate Emergency declaration will include proposals to switch to low carbon vehicles across the Borough's fleet as soon as possible.
GB Met	The College has a small fleet of minibuses and vans and is working towards replacing existing vehicles with electric when current leases expire. Currently two electric vans are on order.
UoB	Supporting our wider plans to decarbonise transport and achieve a reduction in local air pollution, in February 2020, 3 EV pool cars entered operation to enable staff to travel emission-free for business trips. With a progressive return to work, usage and demand for these vehicles will be promoted and assessed this year. This, and other supporting data will be used in our plans to achieve net zero transport emissions by updating our travel plan strategy. Our overall intention is to reduce and remove high impact & uncontrolled pollution created by grey fleet business mileage. The next challenge for us is to support the emergent hydrogen economy; the potential to work with our value chain to decarbonise our contractor fleet offers potential that we plan to explore.
UoS	The University's Sustainability Strategy contains a commitment to "make all of the University's vehicle fleet ultralow emissions by 2025 by only procuring and leasing new vehicles that are ULEVs"
SDNPA	Of a fleet of 27 vehicles, 5 are hybrid electric / diesel and 1 is electric. Looking into lower emission alternatives to Land Rovers and pick-up trucks, but this sector is lagging behind the car and van sectors in providing hybrid / electric models.
Ricardo	Ricardo are addressing the UK's EV battery shortage by leveraging its expertise in niche-volume manufacturing, battery research and development (R&D), second life and recycling, complex supply chain management and strategic consultancy. The company is also harnessing its world-renowned expertise in batteries to explore opportunities to minimise the environmental impact of battery-pack manufacture through 'second life processing' and recycling of core elements from construction. This should help to 'level up' the UK supply chain in critical electric-vehicle components to

	support manufacturers producing fewer than 10,000 electrified vehicles per year. Ricardo's future manufacturing strategy is very much aligned to this emerging need for world-leading electrified vehicle components.
Ricardo	A cleaner fuel source feeding directly into rail operations: Ricardo is part of a consortium aiming to build and connect solar electricity generation directly to the railway network to provide zero-carbon power cheaper than from the grid and deliver as much as 10% of the UK Southern Region's rail power needs. Founded by climate charities 'Possible' and 'Community Energy South', Riding Sunbeams has a vision to power railways with unsubsidised, direct-wire renewable generation while delivering positive social impact to line-side communities. Direct supply of solar power to rail traction systems has significant potential for metros, trams and railways in the UK and around the world. Ricardo has been a partner working closely with Riding Sunbeams since 2019 on solutions for systems at each stage of the development of the proposition.

4. **EV Charging Points:** supporting a huge increase in electric vehicle charging points.

WSCC, Districts & Boroughs	West Sussex County Council and District and Borough Councils, made a decision in August 2021 to award a contract with a company to install, operate and maintain a West Sussex county-wide EV Charge Point network. This will start in November 2021 and involve installing charge points over 15 years to all areas of West Sussex, including Arun, Adur, Crawley, Mid-Sussex, and Worthing. First EVCPs expected to be installed by April 2022.
BHCC	200 lamp-post chargers have been installed. By March 2022 we expect to have 100 exclusive lamp-post recharging bays. The replacement and upgrading of existing fast chargers is complete, with 58 exclusive fast recharging bays installed and operational. Installation of 3 on-street rapid taxi hubs with 18 rapid charging bays (including 6 for public use) has been completed and the charge points are now operational. BHCC is seeing a steady increase in monthly usage as more public charge points come online. The government recently announced that further funding will be made available which will allow for further funding bids for chargers to be submitted this financial year. Planning requirement for 10% parking spaces in new developments to have EV chargers

Crawley BC	A specific commitment is included in Crawley's new Local Plan which requires new development to meet the anticipated demand for Electrical Vehicle (EV) Charging Infrastructure. Provision of EV charging infrastructure in Crawley is further supported by West Sussex County Council's 2019 'Guidance on Parking in New Developments'.
Lewes	Procurement due to start September 2021 for LDC estate EVCPs
GB Met	Installing a charging point at our West Durrington campus and investigating the potential for further charging points at other sites. These will use electricity generated by solar PV panels installed on-site by Brighton Energy Coop.
UoB	Rollout of electric vehicle charge points (EVCPs) has gone from strength to strength, increasing from eight to 63 in one year, following 55 new charge-points now installed at our Moulsecoomb campus multi-story car park. Plans to extend this by a further 50 charge points will be reviewed in 2021. More widely, the regeneration of the Moulsecoomb area through our £300m Big Build programme has enabled us to redesign the community streetscape to promote and prioritise active travel by foot and by bike.
UoS	Sustainability strategy commits the University to "begin to invest in replacing priority fossil fuel dependent infrastructure with lower carbon alternatives by December 2026, with a first step of producing feasibility studies in a number of areas including upgrading electric vehicle, scooter and bike charging infrastructure."
SDNPA	Owns one public charging point, a 50kWh unit

5. **Rewilding:** supporting an increase in natural landscapes and rain garden projects

Key achievements	The Aquifer partnership's Rainscape Campaign – Brighton's first schools raingarden in progress (Moulscoomb Primary). Sussex Nature Partnership established a Local Authority Network to support Environment Bill readiness (nature recovery networks, biodiversity net gain etc) and share best practice around green space valuation and innovative investment. South Downs National Park Authority launched their 'ReNature' nature recovery campaign. Organisations such as BHCC and Southern Water developing land management strategies to help achieve net zero and other commitments

Next steps	GB to champion delivery of robust local plan policies that support the restoration of nature (e.g. through delivery of SUDS) in line with current and emerging environmental legislation.

6. **Home Visits:** supporting Southern Water's 50,000 water and energy efficiency home visits

Key achievements	Adaptation during Covid - home visits had to evolve and water companies now offering virtual home visits. Household water use across the South East has risen as more people are working from home so WaCo's have had to adapt and react quickly.
Next steps	GB continue to use collective voice to push for tighter water and energy efficiency standards in new homes and to champion retrofitting

7. **Low Carbon Heating:** rolling out schemes to replace oil home heating with electric and other low carbon fuels

Adur & Worthing Councils	The Worthing Heat Network project continues, with two rounds of HNDU funding secured in the past year to enable the project to develop a bid to HNIP. This additional legal and technical work allowed a HNIP bid to be submitted in April for significant capital funding for the commercialisation and construction phases of the project. A concessionaire contract is expected to be let in 2022. Public Sector Decarbonisation Scheme funding has been secured to deliver two large heat pump projects at Sheltered Housing sites that will remove gas heating from over 50 homes. A bi-valent heating system will also be installed at the Shoreham Centre. In total, PSDS and Low Carbon Skills funding should deliver a 5% reduction in the councils' carbon emissions in one year.
BHCC	Currently scoping out the next contract for heating and hot water provision in council-owned housing, that will support a transition away from gas over the next 10-15 years. Installed some air-source heat pumps in council housing over the last year.
Crawley BC	Crawley Homes working on plan to decarbonise social housing and working with Net Zero collective to develop deep retrofit plans progressing with trial of initially 10 house archetypes that will inform blueprint for decarbonisation for whole housing stock. Crawley Town Centre District Heat Network is currently under construction, due for completion in Feb 2022, which will contribute 35%

	carbon reduction on BAU. Connected to three social housing blocks (approx. 300 units) and the new Civic Centre and commercial offices.
SDNPA	Currently supporting the development of a Community Renewables Pathway for the National Park Area. As a pilot, SDNPA supported 5 community groups/rural parishes to develop plans for their area and look at funding opportunities. A plan is being developed on how this pilot can be rolled out across the National Park as a whole. We have started a project supporting the farming sector to understand their carbon footprint and support rapid transition to low carbon. This will be delivered through working with the Farm Cluster groups across the National Park.
UoB	Setting the standard and demonstrating what is possible is key to a creating a future vision for our students and staff. Reflecting sustainability as one of our four core values, we've achieved the BREEAM 'Excellent' Standard for sustainable design and construction at our £300m campus development at Moulsecoomb. This approach reflects our ambitions for delivering buildings fit for the future, as outlined in a forthcoming updated Estates strategy. Decarbonisation of both power and heat is a key priority. Building on our work on the innovative thermal energy storage system to provide low-carbon heating and cooling, we shall undertake a feasibility and options approach to retrofit our campus buildings with low and zero carbon heating, including new local heat networks. This will be undertaken with the intention to develop local expertise and provide experience and work opportunities for our students.
UoS	Committed to beginning a feasibility study on the replacement of our Combined Heat and Power Plant with a low carbon alternative by December 2021
OVESCo	The CommuniHeat project plans to take the parish of Barcombe off oil and switch to electric heating. The project delivery partners are OVESCO, Community Energy South, Buro Happold and UK Power Networks. https://communiheat.org/

8. **Public Buildings:** reducing energy use by 50 per cent by 2030

Adur & Worthing Councils	Nearly £2m of Public Sector Decarbonisation Scheme funding has been secured to deliver two large heat pump projects at Sheltered Housing sites that will remove gas heating from over 50 homes and a bi-valent heating system will also be installed at the Shoreham Centre. Additional energy efficiency measures will be installed in Civic Buildings in Worthing as well as 6 solar PV arrays on corporate buildings.

	In total, PSDS and Low Carbon Skills funding should reduce the councils' carbon emissions by over 5% in one year.
Arun DC	Currently implementing a carbon audit for our Scope 1, 2 and 3 emissions. The audits for the main corporate buildings will develop a road map to help them get to net zero.
BHCC	Solar PV installations with a peak capacity of 330kW were commissioned across the corporate portfolio in Spring 2021, producing 200mWh of renewable electricity in the first five months of operation and saving around 50 tonnes of CO_2. An additional tranche of Solar PV arrays with a peak capacity of 500kW are planned to be installed at the tail end of 2021/22, with feasibility & financial appraisals currently being produced. Consultants were commissioned to produce a pilot of energy audits to provide a pipeline of feasible efficiency projects for future investment or to take advantage of any available external grant funding. Additional funding was awarded through the Low Carbon Skills Fund in September 2021, to secure consultants to carry out remaining efficiency audits across corporate & school sites. The findings from these studies will be used to form a Heat Decarbonisation plan and a pipeline of feasible efficiency measures focussing on a 'Whole Building' approach.
Crawley BC	New Town Hall being constructed, connected to District Heating Network, to BREEAM Excellent standard; due for completion Spring 2022
GB Met	Solar PV has been installed at our Pelham, East Brighton, West Durrington and Shoreham campuses in conjunction with Brighton Energy. This will provide power for our sites with surplus returned to the main network. We have submitted a bid for significant capital funding to improve the performance of Pelham Tower by undertaking work to reroof, re- glaze and clad the building, reducing energy consumption.
UoB	Building on our work on low carbon buildings we are one of the top-10 UK universities for solar power, and our 1500 solar panels generate over 445,000kWh per year - equivalent to energy used in 150 homes. New innovative partnership approaches with Brighton Energy Cooperative have overcome financial and technical barriers to implementation with our demonstration of solar-powered electric vehicle charge points at Varley Park student halls of residence.
UoS	The Sustainability Strategy commits to improving the energy efficiency of our estate. We will undertake an initial high-level audit of the energy efficiency of all of our buildings to identify the most cost-effective ways

	of reducing energy consumption by December 2021. We will then take these findings to prioritise a more detailed audit of the 20% of the most poorly performing buildings by 2023 and complete a detailed investment opportunity analysis of the entire estate by 2030. We are currently undertaking the first round of these audits – including the auditing of our library, which is a core public building as our special collections are accessible to anyone in the community.
SDNPA	Roof-mounted PV panels generate approx. 7000 kWh p.a. Submitting a Planning application to replace a biomass boiler in the Hall with air source heat pumps. This system would still require a gas back-up but the gas would be used a lot less than before. Other measures include a full refit of the lighting to LED units; Aquatron movement-detection controls on water use; and a Building Management System to monitor and control energy consumption.
OVESCo	OVESCO is in the process of taking a Solar Park of approximately 16mW through the planning process. The site is located in Lewes District and has secured development land and a grid offer. There is potential for site to sell electricity via PPA to a local off-taker Q4 2022
Next steps	Local authorities are planning audits of corporate and commercial buildings to support programmes of energy efficiency and bidding for funds. Greater South East Energy Hub is supporting local authorities to bid for government decarbonisation funds.

9. **Innovation:** establishing an Innovation Forum to share latest research and best practice

Key Achievements	Sussex Innovation Forum (UoS) established with Green Growth Platform business services (UoB) to explore innovative approaches to decarbonisation of infrastructure. Innovation Ecosystem Development Group, chaired by UoB, is exploring ways to support the use of economic innovation to support the GB pledges. UoB and Green Growth Platform convened a workshop to develop science and practitioner led project(s) to advance knowledge and practice for the restoration and management of wetlands and coastal habitats, in order to deliver benefits in terms of carbon storage, biodiversity gains and other eco systems services. Extensive programme of research to advance Pledges 1-10 under way - see list of research projects at Appendix 2

	UoB is the research lead for the GBEB Retrofit Taskforce supporting the decarbonisation of social housing stock (Phase 1).
Next steps	Academic-led collaboration between both universities to convene key GBEB decision-makers and scope out a Green Blueprint (ie a route map) for becoming a net zero city region, drawing on developments and learning to date across all other GBEB pledges and plans. The Green Blueprint will set out what changes need to be made, by when, who is responsible, likely costs, dependencies, consequences and risks. It will serve as a guide for major investment planning, policy change and organisational action.

10. **Lobby:** using Greater Brighton's powerful voice to lobby government for investment

At the Greater Brighton Economic Board meeting in July 2021, the Board agreed to the host a regional climate summit and to develop a net-zero innovation led Blue/Green Investment Plan. Both were identified as opportunities to be leaders in the UK's green industrial revolution, to lobby government and to attract investment to accelerate the transition to net zero.

These pieces of work demonstrates that Greater Brighton (a unique sub region which includes a small city, rural communities, deprived coastal areas, a National Park and a UNESCO Biosphere) can amplify a coherent voice and call for ongoing discussions with government and negotiate on funding. This Blue/Green Investment Plan will include a pipeline of investment projects – showcasing the work taking place and revealing our ambitious next steps – to take the form of a 'Pitch Document'.

The Blue/Green Investment Plan would be the overall strategy and each of the projects in the pipeline would have an outline business case in readiness to pitch for investment. The main benefit from this work will be to shape the thinking of local government, business partners and the LEP into how they approach a post-carbon economy for the area. Once delivered, this pitch document can be communicated to government to drive government interest in the activities of the region leading to investment.

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Appendix 2 - Developing new solutions for tackling climate change: some examples from University of Sussex

Innovation	Academic lead/ research group	Outline	GBEB Pledges
Electric vehicle battery developments	Prof Peter Kruger Sussex Programme for Quantum Research (SPQR)	▪ Just completed: a new quantum sensor commercial battery imaging system co-developed with local green energy start-up, CDO2, unveiled at low carbon vehicle technology event Cenex-LCV (22-23 September 2021). ▪ Under development: Safer more efficient batteries for airline industry	3, 4 & 9
Energy demand & infrastructure planning	Profs Tim Foxton, Steven Sorrell, Dr Mari Matiskaninen Dr Ralitsa Hiteva Centre for Research into Energy Demand Solutions (CREDS)	Consortium researching into the changes in energy demand needed for the transition to a secure and affordable, low carbon energy system and the implications for infrastructure planning. Live project: Sussex University-sponsored programme of Innovation Forums on tackling aspects of climate change for local stakeholders.	4, 7, 8 & 9
Kelp	Dr Mika Peck	Expert in the conservation of tropical environments and development of new tools to monitor the state of the environment, from tropical rainforest to reefs. Live project: Sussex University-sponsored kelp sample collection (with University of Brighton) and evaluation to produce a roadmap for kelp farming in Sussex Bay area.	1, 3 & 9

Net zero neighbourhoods	Dr Marie Claire Brisbois & Dr Donal Brown	Experts in domestic energy policy. Live projects: ▪ Improving energy efficiency in private rented accommodation, working with the UoS student accommodation service; stakeholder event planned in Oct / Nov (incl. landlords, letting agencies, BHCC private housing team and Sussex Student Lettings) to expand the project ▪ Analysing EPC and HMO data to correlate relationship between housing condition and landlord type ▪ Consortium with Glasgow & Leeds to understand consumer behaviour in energy choices.	3 & 7
Improving water pump and domestic appliance efficiency	Dr Esra Sorguven, Thermo-fluid Mechanics Research Centre	Live project to improve energy efficiency of water pumps through novel flow measurement techniques (Sussex funded project, working with Southern Water) Several live projects to improve the design and manufacturing of domestic appliances which use c 2.5% of the UK's energy consumption and generate £7bn in annual revenue – with Beko; Arcelik & AIRONN.	2, 3 & 9
Hydrogen Engineering expertise	Dr Spyros Skarvelis-Kazakos Dynamics, Control and Vehicle Research Dr Fan Zhang	Expert in hydrogen-related technologies and a member of the Supergen H2FC Science Board (http://www.h2fcsupergen.com/wp-content/uploads/2019/01/UK-H2FC-Capability-Document.pdf - see p.90). **Smart grids:** His current focus is on hydrogen as a multiple energy carrier optimisation and on increasing renewable energy capacity by improving electricity grid reliability and controllability (thus reducing the impacts of the uncertainty of renewables). Expert in hydrogen embrittlement of duplex stainless steel: Hydrogen embrittlement is a widely known phenomenon in high strength materials that are responsible for subcritical crack growth in material, fracture initiation and catastrophic failure with subsequent loss in mechanical properties such as ductility, toughness and strength. Hydrogen energy systems are reliant on the production, transportation, storage, and use of gaseous hydrogen. The safety, durability, performance and economic operation of these systems is challenged by the hydrogen embrittlement of the materials. Fan has the expertise required to assess safety and materials efficiency in a demonstration project.	3, 7 & 9

	Dr Kun Liang Prof Julian Dunne	Expert in hydrogen laminar flame measurement and engine performance with addition of hydrogen. Recently he has some work on cryogenics systems which can re-liquify hydrogen if there is boil-off gas in the charging point. Kun has the expertise required for engine performance measurements and modelling hydrogen combustion in IC engines, as well as similar measurements and modelling in CHP. Developed new patented technologies at Sussex for free-piston engines offering electrically-controlled VCR (variable compression ratio) needed for hydrogen or ammonia combustion in internal combustion (IC) engines. Free-piston engines are being seriously considered for hybrid electric powertrains, either in series propulsion or as a range extender.	
Zero waste RFID tags using new nanomaterials	Prof Alan Dalton Materials Physics Group	Commercial work with business partner AMD to develop a number of graphene based nanomaterials which are metal-free and more ecologically-friendly. Current developing an alternative metal-free radio-frequency identification tag for use by supermarkets to track products with major supermarket chain.	3 & 9
Vehicle to Grid optimisation	Dr Arash Moradinagade-Dizkah Dynamics, Control and Vehicle Research	Live project: ▪ Optimisation and control, energy efficient control allocation, vehicle to grid and smart grids	3, 4 & 9
Improved efficiency of current combustion engines	Profs Julian Dunne & Peter Fussey Dynamics, Control and Vehicle Research	Live projects: ▪ Optimised Resonating Free Piston Generator ▪ Evaporative Cooling of Internal Combustion Engines - with Ricardo. Technology available to be licensed: High Energy Density Power Generator.	3 & 9

Renewable Power generation	Prof Martin Rose	Expert in renewable power generation – urban wind and wave. Live project to design wind powered car “Sussex Power Storm”	3 & 9
Future Refrigeration: ammonia linear compressor	Dr Kun Liang	International partnership to investigate future refrigeration systems using a novel oil-free linear compressor and ammonia as refrigerant. The benefits of such systems are zero ozone depletion potential (ODP), zero global warming potential (GWP), high efficiency and low cost Live Sussex University-sponsored project to support linear technologies including development of Stirling engine for electric vehicle range extension	3 & 9 3, 4 & 9
Renewable energy from waste	Dr Mark Puttock-Brown	Experimental and numerical investigation of heat transfer and fluid dynamics of rotating cavities in gas turbine secondary air systems working with partner GE Aviation Numerical design of radial turbines for waste heat recovery utilising organic working fluids	3 & 9

Appendix 3 – Alignment of academic expertise to GB10 pledges: some examples from University of Brighton

Elements of the University of Brighton's contribution to the GB10 pledges are incorporated in the main paper. This appendix provides signposts to additional information on core expertise relevant to the pledges and examples of recent work and collaborations. This is not intended to be a definitive list and further detail can be provided as activity relating to the pledges progresses.

GB Pledge	Leading academic expertise	Examples of recent work and collaborations
1: Kelp	Dr Ray Ward, Centre for Aquatic Environments	- Natural England report on carbon sequestration and storage in aquatic habitats including kelp forests - Member of the scientific advisory panel for the Help Our Kelp campaign
2: Water recycling	Professor James Ebdon and Dr Ian Mayor-Smith, Environment and Public Health Research & Enterprise Group	- Collaborative project with Southern Water on water reuse strategies for the South East
3: Zero emission fleets	Dr Penny Atkins, Advanced Engineering Centre Professor Rob Morgan, Advanced Engineering Centre	- Report on Hydrogen engines' role in decarbonising the heavy duty sector - Hydrogen engine prototype testing with Ricardo - Co-development of the near zero-emission recuperated split-cycle engine with Dolphin N2
7: Low carbon heating/8: Public buildings	Professor Marco Marengo & Dr Marco Picco, Advanced Engineering Centre Incoming Professor of Sustainable Construction Professor Mohammed Arif	Spin-out providing building energy assessments during planning stages

	Duncan Baker-Brown	Brownfield development, modular building and associated sustainable building practices. Sustainable building design, circular economy