

Sustainable Jet Fuel from Flexible Waste Biomass

Deliverable D9.10: Open Research Data Pilot

for:
European Commission
Agata Przadka
Innovation and Networks Executive Agency (INEA)
Chaussée de Wavre 910
W910 03/30
B-1049 Brussels



presented by flexJET project consortium

Short	Beneficiary	Role
UoB	THE UNIVERSITY OF BIRMINGHAM	CO
Fraunhofer	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	BEN
UNIBO	ALMA MATER STUDIORUM - UNIVERSITA DI BOLOGNA	BEN
Susteen UK	SUSTEEN TECHNOLOGIES UK LTD	BEN
WRG EUROPE LTD	WRG EUROPE LTD	BEN
GREEN FUELS	GREEN FUELS RESEARCH LTD	BEN
HyGear B.V.	HYGEAR BV	BEN
BIGA Energie	BIGA ENERGIE GMBH & CO KG	BEN
ETA	ETA - ENERGIA, TRASPORTI, AGRICOLTURA SRL	BEN
SKYNRG	SKYENERGY BV	BEN
LEITAT	ACONDICIONAMIENTO TARRASENSE ASSOCIACION	BEN
SUSTEEN GMBH	SUSTEEN TECHNOLOGIES GMBH	BEN
USFD	THE UNIVERSITY OF SHEFFIELD	BEN

CO: Coordinator, BEN: Beneficiary

Birmingham – UK, 25 September 2018

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 792216.



General Information

Call identifier: H2020-LCE-2017-RES-IA
 GA Number: 792216
 Topic: LCE-20-2016-2017
 Start date of project: 01/04/2018
 Duration: 48 months
 Work Package: WP9 – Dissemination
 Type: Deliverable
 Number: D9.10
 Title: Open Research Data Pilot
 Due Date: 30/09/2018 (Month 6)
 Submission date: 08/10/2018
 Reference Period: 01/04/2018 – 30/09/2018

Prepared by: University of Birmingham, ETA
 Responsible Persons: Miloud Ouadi, Lais Galileu Speranza, Sara Momi, Stefano Capaccioli
 Dissemination Level: Public

Document Type		
<i>PRO</i>	Technical/economic progress report (internal work package reports indicating work status)	
<i>DEL</i>	Technical reports identified as deliverables in the Description of Work	X
<i>MoM</i>	Minutes of Meeting	
<i>MAN</i>	Procedures and user manuals	
<i>WOR</i>	Working document, issued as preparatory documents to a Technical report	
<i>INF</i>	Information and Notes	

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	
CON	Confidential, only for members of the Consortium	



TABLE OF CONTENTS

- 1 EXECUTIVE SUMMARY..... 4**
 - 1.1 Description of the deliverable 4

- 2 DATA MANAGEMENT PLAN..... 4**
 - 2.1 Data summary 4
 - 2.2 FAIR data 7
 - 2.3 Allocation of resources..... 11
 - 2.4 Data security..... 11
 - 2.5 Ethical aspects 11
 - 2.6 Others..... 12

- 3 COMMENTS AND CONCLUSIONS..... 12**

- 4 ACKNOWLEDGEMENTS..... 12**

- 5 REFERENCES..... 12**



1 EXECUTIVE SUMMARY

The flexJET project will build a pre-commercial demonstration plant for advanced aviation biofuel (jet fuel) derived from food waste and waste vegetable oil. The project involves 13 partners (9 industrial partners and 4 research organisations) in 5 countries.

The flexJET consortium accepted to be part of the H2020 Open Research Data Pilot and by doing so developed a Data Management Plan that is presented in this deliverable.

The aim of the Open Research Data Pilot is to support data sharing generated/collected by this H2020 flexJET project for access and reuse by the scientific community worldwide. flexJET will produce some publically available documents for publication and dissemination to a wider audience outside the consortium and thus this open access is what is discussed in this deliverable.

The data management plan define the initial guidelines for data generation and dissemination and determine how the data will be managed during and after the end of the project. It was based in the work plan discussed and approved by all members of the consortium.

Since it is a live document, the consortium decided to take advantage of the DMPonline tool in order to access it anytime it is needed and update it through and will be update through the project period.

This deliverable has been prepared, and necessary further versions will be updated by project coordinator UoB, as partner responsible for this task, under the supervision and with the contribution of the WP leader ETA.

1.1 Description of the deliverable

The flexJET D9.10 is a public report with the data management plan for the flexJET project.

2 DATA MANAGEMENT PLAN

2.1 Data summary

Purpose of data collection/generation

The data in flexJET will be generated and collected by the 13 partners (9 industrial partners and 4 research organisations) distributed in 5 EU countries. The data has the purpose to complete the objective described in the grant-agreement. They are:

1. Demonstrate technical viability and cost-competitiveness of the production of aviation fuels by the validation of SABR-TCR technology through the deployment of an integrated plant combining the transesterification of waste vegetable oil with a TCR500 unit with pressure swing adsorption and HDO units for the production of jet fuel from the organic waste (food waste).
2. Validate logistical advantages through analysis of regional/local integrated supply and demand strategies and evaluate environmental and social sustainability of the integrated small-scale hydrogen separation and purification (PSA) and HDO modules with the SABR-TCR unit vs existing production methods through centralized petrochemical infrastructure.
3. Contribute to the Renewable Energy Directive targets for renewable energy by validating waste feedstock for the production of transport fuels.
4. Facilitate the commercial availability and medium term market penetration of advanced biofuels at large scale, through the introduction of liquid biofuels (jet fuel) to existing markets, utilising current distribution infrastructures where possible and by developing robust business strategies based on market success factors quantified through this project.



Relation of research data with flexJET objectives

In order to achieve project objectives, flexJET foresees seven (7) research work packages that will generate the scientific and technical data. Data generated within the project will be supporting both technology and performance development. The work packages, objectives and expected data are presented in the table below:

Table 1. Collected/generated data by objective (WP)

WP	Objective	Expected collected/generated data
1	To ensure efficient management of the flexJET project by the consortium as a whole and operation of an effective consortium management structure	Management WP – No research WP – No data generation
2	To design and build the integrated SABR-TCR plant	Design and technology development data
3	To demonstrate the technical viability of the integrated approach through the operation of the integrated SABR-TCR plant at the demonstration site	Scale-up and Operation data
4	To perform extensive quality control/testing of the feedstock and product jet fuel from the demonstration site and demonstrate liquid fuel suitability for aviation applications according to ASTM D7566	Analytical data (feedstock and products)
5	To evaluate the social sustainability of the process through analysis of consumer perceptions and behaviour	Social sustainability data
6	To quantify environmental sustainability of integrated SABR-TCR technology and to prepare the application for the RSB certification of the aviation biofuel produced	Environmental sustainability data
7	To validate a business plan for the full scale commercial flagship plant	Commercial data assessment
8	To identify and mitigate potential risks to the project outputs and develop models of best practice for regulatory/technical/logistical issues	Data on compliance with regulatory, legislative and normative standards
9	To implement a comprehensive public and industrial dissemination policy	Dissemination WP – No research WP – No data generation

Types and formats of data generated/collected

All formats of digital files stand the risk of becoming obsolete in the future. As a general guideline, flexJET considers that the file formats best suited for long-term preservation and accessibility:

1. are commonly used;
2. have open specifications;
3. are independent of specific software, developers or suppliers.

Hence, project research teams will convert data from proprietary formats and make them available in well-known and documented open formats, as in Table 2.

Documentation files explaining all relevant details regarding data collection, processing methodologies and quality assurance will be deposited either in institutional or other thematic-based public repositories along with the datasets in several formats (.odt, .rtf, .pdf, etc.).

**Table 2. Data formats**

Type of data	Formats used during data processing	Formats for sharing reuse and preservation ¹
Numerical or textual tabular data	Microsoft Excel (.xls/.xlsx)	Comma-separated values (.csv)
Qualitative textual data	Microsoft Word (.doc/.docx)	Rich Tech File (.rtf) Non-Unicode TXT (.txt) OpenDocument Text (.odt) PDF/A (.pdf) Txt file (.shp format)
Numerical or qualitative textual data	Acrobat Adobe Reader (.pdf)	PDF/A (.pdf)
Spreadsheets	OpenDocument Spreadsheet (.ods) Comma Separated Values (.csv)	MS Excel (.xls, .xlsx) PDF/A (.pdf) OOXML (.docx, .docm)
Topic modelling data	Mallet format (.mallet)	Comma-separated values (.csv)
Simulation model data	Text model format (.mdl)	The mathematical model could be saved using standard differential equations symbols in .rtf, .csv and .txt files in case the simulation model is developed using a proprietary software. Simulated values will be saved as numerical data.
Statistical tabular data	STATA format (.dta)	Comma-separated values (.csv) STATA format (.dta) MS Excel (.xls)
Geospatial vector data format for geographic information system (GIS) software	Shape GIS format (.shp – shape format, .shx – shape index format, .dbf – attribute format)	Shapefiles can support point, line, and area features. Area features are represented as closed loop, double-digitized polygons. Attributes are held in a dBASE® format file. Each attribute record has a one-to-one relationship with the associated shape record.
Audio data	mp3 format (.mp3)	Audio recordings will be deleted after their transcription and only the processed transcripts will be shared and preserved.
Images (raster)	JPEG (.jpg, .jpeg) TIFF (.tif, .tiff) PNG (.png)	JPEG 2000 (.jp2)
Images (vector)	scalable vector graphics (.svg)	Adobe Illustrator (.ai) PostScript (.eps)

The project will also reuse a variety of existing data from several sources. The expected size of the data is still uncertain at this early stage of the project. It is expect to re-use existing data from older projects from the partners, such as the TO-SYN-FUEL project.

¹ As it is not always possible to select formats that meet with all the ideal attributes, a number of file formats has been listed and considered as suggested ones in this table. This list could be change over time as new formats will be developed and others will fall into disuse.



All data, information and support material generated within the project will be centrally stored on the coordinator central computers using their standard archiving data control procedures and routinely backed up onto secure areas on a central server, according to standard policies and procedures.

The consortium expects research data will be collected and/or generated by the partners: UoB; Fraunhofer; UNIBO; Susteen; Green Fuels; LEITAT and USFD. By 2025 it is intended to have 12 publications (IF >3) and at least 2 patents and IP protect activities. Potential users of flexJET expected research data are: *researchers, policy makers, market entities, students, practitioners and stakeholders interested in the project outputs.*

For guaranteeing open dissemination and preservation of research data by all research teams generating and/or collecting research data in flexJET project, and in order to cope with the EC H2020 requirement on Open Access, the consortium is keen to consider Zenodo (www.zenodo.org) as a suitable repository, in addition to the institutional ones that will be described later in the document. This choice is based on its functionalities: it provides a full interface which enables linking research outputs to datasets and funding information (link to EC CORDIS); it is integrated by GitHub; organizations can submit either Open Access publications and datasets; all open content is harvestable via OAI-PMH by third parties; all the different versions of a file can be supported by a top-level DOI; data is stored at CERN, counting on considerable experience operating large scale digital repositories; data files and metadata are kept in multiple online and offline copies; research materials can set to share with reviewers only, and also embargoed.

As soon as research data are ready and only after the agreed decision taken by the relevant flexJET governing bodies (the Steering Committee and the Management Board) that access to such research data is not restricted for legitimate market/commercial exploitation/IPR reasons, research data and information will be made publicly available on selected repositories. In addition, they will be disseminated to the scientific community and relevant stakeholders through presentations at internal and external scientific conferences and publications in open access peer-reviewed journals.

2.2 FAIR data

2.2.1. Findable

Metadata for all research data generated/collected throughout the project will be recorded by their creators and in the University of Birmingham's current research information system PURE. These records will be searchable within the University's Research Portal, FindIt@Bham (the library discovery tool) and Google.

All publications will have a Digital Object Identifier (DOI) assigned and they will contain key the words flexJET and SABR-TCR. On **specific keywords** to be chosen for being representative of datasets, the policy agreed at consortium level is to derive them, when possible, from thesauri and controlled vocabularies. Then, they will be associated to each dataset with the aim of enhancing semantic discoverability.

All relevant documentation explaining **data collection procedures and analysis** (such as codebooks, methodologies, etc.) will be made available along with the data, to guarantee their intelligibility, reproducibility and the validation of project findings.

Datasets will be described using **standard metadata** – such a Dublin Core and DataCite Metadata Schema, coherently to what entailed by the OpenAIRE guidelines, as well as what indicated by the Research Data Alliance (RDA) on the Metadata Standards Directory. Thanks to this approach, metadata will be interoperable, so indexing and discoverability of datasets will be guaranteed at all levels. Other disciplinary standards will be taken into consideration by the flexJET consortium, on the basis of each scientific sub-disciplines interested by the project.



On **dataset naming**, the consortium proposed a scheme which permits and improves data visibility, discoverability, citation and permanent online tracking. Hence, the recommended title for each dataset consists of:

PROJECT ACRONYM: WPnumber: WP title or description specifying WP aims: Tasknumber: Task title or description specifying Task aims: additional information specifying coverage and nature of data (if necessary): version number (in case of revisions and updates)

The version number of the dataset will be added at the end of the title (in case of data revision), resulting in a viable support to help identifying datasets updates and changes, with reference to repositories that do not track versioning in an automatic way.

The DMP recommends also the following rule for **file naming**:

- for dataset file(s):
DATASET_flexJET_WPnumber_Tnumber_assessment or other content specifications_date (YYYYMMDD)_vn.file extension
- for the dataset relevant documentation explaining data collection procedures and analysis (such as codebooks, users' manuals, methodologies, etc.):
README_flexJET_WPnumber_Tnumber_assessment or other content specifications_date(YYYYMMDD)_vn.file extension

WPnumber stands for "work package number", *Tnumber* is "task number" and *vn* is the version number (in case of data revisions or updates).

2.2.2. Accessible

As a guiding principle, the project seeks to make research data openly available, whenever possible ("as open as possible, as closed as necessary" as set by the EC), for allowing their dissemination, validation at public level and re-use of research results in an easier way. To this purpose, all the files will be converted to standard and well-documented open formats and the datasets will be deposited together with all relevant documentation and explanation.

The consortium agreed to identify a preliminary list of cases where restriction on data access or impossibility to share them will be considered, such as:

- data of third party: when collected data belongs to one or more third party/ies who have denied permission for sharing them on the basis of confidentiality and proprietary issues;
- other specific cases (when availability of data would mean that the project's main aim might not having been achieved - reasons are explained in Annex I, under the "accessibility section" of each dataset table) and legitimate reasons.

Therefore, all possible and legitimate actions and strategies will be adopted to allow data sharing including:

- obtaining copyright permissions from third party data owners to be allowed to re-use, reproduce and distribute the collected data;
- converting the files to standard open formats;
- providing all relevant documentation and explanation for data and datasets;
- in case of copyright on raw data derived, collected or elaborated from pre-existing databases or from other original sources (e.g. papers, journal articles, book chapters, reports, video and audio sources), collected data will be made available if the reproduction and sharing are allowed by



expressed permission of the right holders or by applicable copyright exceptions and exemptions. Reproductions and communication of brief excerpts of texts and other protected works are permitted for illustration purposes at scientific research level, provided that the source, including the author’s name, is acknowledged and provided that the use does not conflict with the exploitation of the original source and does not unreasonably prejudice the legitimate interests of right holders. Otherwise, only aggregate data resulting from the analysis will be openly published. Anyway, when the sources are freely available on-line in their original repositories, but direct reproduction is not allowed, a detailed account on how the dataset was created from the original data will be provided, together with the specification of open repositories from where the original datasets are available. Raw data consisting in full-texts will not be made available without copyright holders’ permission.

With reference to data falling under one or more restrictions described before and for which is not possible to take any action to make them shareable, the EU allows restricted access to them or complete closure. The flexJET DMP will indicate the versions or parts of the datasets that cannot be freely shared providing the specific motivations described.

At the time of results’ publication, researchers will deposit the project data that can be shared in a data repository, with the aim to guarantee their discoverability, access and preservation beyond the end of the project.

Data repositories chosen by the partners are institutional, disciplinary and public repositories. They are fully compliant with long-term preservation and attribute persistent unique identifiers to the archived datasets (such as Handle or DOI). They support open licenses and different access levels. Finally, they adopt descriptive metadata standards as required by the OpenAIRE Guidelines and allow cross-linking between publications and relevant datasets, guaranteeing their compatibility with OpenAIRE requirements.

Each different dataset is deposited by the team that responsible for data collection and management in the repository of their choice. Repositories decided so far are presented below:

Table 3. Summary of repositories

Partner	Repository name	URL	Type
UoB	eData repository	https://edata.bham.ac.uk/	Institutional
USFD	ORDA	https://orda.shef.ac.uk/	Institutional
ETA	Zenodo	https://zenodo.org/	Multi-disciplinary

Data will be shared through the repositories which makes the datasets discoverable through search engines like Google. eData uses Dublin Core as a metadata standard and the minimum metadata provided for published datasets will cover amongst others title, type of data, creators, publication date and related publications.

To facilitate intelligibility and reuse, the datasets will be deposited in the data repositories along with all relevant documentation explaining data collection procedures and analysis. The consortium members will have all data available for download in an online cloud (intranet project area – BEAR DataShare).

In general, the consortium does not consider that specific software are needed to access project data, since researchers will convert the data into open formats. In case any specific software is used for data processing, full explanation and instructions will be included in the deposited documentation.

Dissemination of high-level technical progress will take place through scientific research papers, published in open access journals. Academic and industrial conferences will also be used to dissemination. Data generated/collected in the project, whose access is not restricted for legitimate



market/commercial exploitation/IPR reasons will be public and available through H2020 portal. The data will be also accessible in the project website and social media.

Partners committed that all appropriate information, data analysis and outputs will be placed freely in the public domain in open access repositories, or under open license, to encourage the uptake and implementation of project results. That, in respect of any issues arising at IPR level regime will be resolved in accordance with the guidelines on knowledge and IPRs laid down for the Horizon 2020 Programme and as defined in the Consortium Agreement. Special attention will be paid to the regulation and handling of the need to keep IP specific results confidentially, as well as the demand of the scientific partners to publish.

2.2.3. Interoperability

All datasets will be described using standard descriptive metadata, such as Dublin Core and DataCite Metadata Schema for ensuring metadata interoperability for indexing and discoverability. All relevant documentation explaining codebooks, users' manuals, data collection procedures and analysis will be made available along with the data, in compliance with requirements of intelligibility, reproducibility and validation of project findings. Variable names of data derived from other official sources will be consistent with the original source names.

2.2.4. Re-use

In flexJET, all shareable data will be shared by adopting licenses that allow re-use of the data and of datasets in their entirety by other researchers/scholars and stakeholders of policy and market sectors.

The EC Open Access policy asks researchers to make available in Open Access their 'peer reviewed articles'. This is easiest to comply with when the researcher retains his/her copyright and only gives the publisher of the article a 'licence to publish'. In that case, the article can be deposited in a repository and made publicly accessible without further permission of the publisher. If the licence stipulates an embargo period, of course that must be respected.

Creative Commons licences² are available in many countries for authors who wish to retain their copyright and provide their publisher with a licence.

Hence, in flexJET datasets will be made available mainly under **Creative Commons license CC BY 4.0**³ and **Open Data Commons ODC-BY**⁴:

- **CC BY 4.0 license** permits users to freely share, modify and use the data, subject only to full credit to the author(s). As an exception, CC BY NC 4.0 (nota), which requires full credit but limits reuse for commercial purposes, will be chosen when the data is collected from pre-existing sources that limit their free reuse (e.g. when exception for illustration of scientific research is applicable, the reproduction of short excerpts will be possible only for not-commercial purposes);
- **ODC-BY license** is specifically drafted for Open Data projects that works under condition of compatibility with Open Access requirements, interoperability and reuse.

In general, data will be made openly available as underlying data necessary to validate the research results immediately at the time of the publication of the corresponding scientific papers and public reports. Some datasets are expected to be part of public deliverables, hence here data will be made available at the time of the release of the corresponding deliverable.

² <https://creativecommons.org/>

³ <https://creativecommons.org/licenses/by/4.0/>

⁴ <https://opendatacommons.org/licenses/by/>



It is possible that an embargo period may be applied to some datasets to allow full exploitation of research results by Partners. However, at current project stage, it is not possible to predict all the datasets to which the embargo will be applied and its duration.

Data will be given full citation from official project publications and website and they will be made available in open formats through institutional or public data repositories compliant with OpenAIRE requirements that guarantee long-term preservation to the archived items, therefore they will be re-usable by third parties also after the end of the project.

As the data collected or generated by the project are heterogeneous, the quality of the data will be carefully assured using several approaches already identified at this stage by the consortium.

Open Access to research refers to the right to access and re-use digital research data under the terms and conditions set out in the Grant Agreement. Openly accessible research data can typically be accessed, mined, exploited, reproduced and disseminated free of charge for the user.

2.3 Allocation of resources

Costs for making flexJET data FAIR were allocated during the funding process and are discriminated at the grant agreement. flexJET has work packages dedicated to Project Management (WP1) and Dissemination (WP9). The partners that will generate/collect data have also already allocated resources for open access peer-review publications and scientific conferences participation, so these data dissemination is covered under the responsibility of its generator budget. The partners that allocated budget for publications in Open Access, IPR and patents are: UoB; Fraunhofer; UNIBO; Susteen and Green Fuels.

The data management will be done by the project manager (University of Birmingham) in cooperation with partners in charge for project dissemination (ETA and WRG). Resource for this work was allocated under work packages 1 and 9.

2.4 Data security

Each research partner generating/collecting data will be responsible for the security and long term storage of their own data.

In progress working data will be stored on the University's Research Data Store which provides replicated and backed up storage. It is not anticipated that this project will generate more than the standard allocation of 3 TB therefore funds are not required for data storage. The University of Birmingham's Research Data Management Policy (https://intranet.birmingham.ac.uk/rdm/UoB_Policy) asks its researchers to assess which research data should be retained at the end of a project and preserved in the long term, for a minimum of 10 years. To retain data associated with published research and completed research projects University of Birmingham IT Services operate a Research Data Archive (RDA), accessed through the University's data repository. Other research partners will follow their own repository policies.

2.5 Ethical aspects

The flexJET project does not foresee to collect any personal or sensitive data.

At each institution, **raw data** will be stored by each partner in computers, laptops, intranets or hand-drives following their own standard procedures (e.g. they are accessible through institutional password, periodically modified according to national law provisions for data security and regularly protected by updated antivirus systems).



All the research materials stored in computers are subject to regular backup for safeguarding them in case of any accidental loss. If mobile devices are used to store data files (e.g. backup files), they will be kept in a safe place accessible only to the researchers involved or will be encrypted with ad-hoc software.

None of the project data will be left inadvertently available.

The **processed data** will become available in the form of project reports and Open Access publications. This data will be further exploited in webinars, articles in professional journals, and by conference presentations.

Access to research data which is not marked as confidential will be granted via a repository.

Currently research teams are sharing data through Google Drive. In this case, as well, regular backup of the data would be performed to ensure data recovery. In addition, all partners are asked to keep local updated copies of all their files.

Long-term preservation of public data is ensured by data repositories already chosen or to be chosen by partners, having specific preservation policies. The general rule of repositories is that data will be preserved for (at least) 10 years. After this 10-year retention period, further retention will be reviewed by the repository managers.

No other national/funder/sectorial/departmental procedures for data management are taken into consideration in this first version.

2.6 Others

The research data will be managed in compliance with the Data Protection Act 1998 (<http://www.legislation.gov.uk/ukpga/1998/29/contents>) and the international law for data protection. flexJET will not collect personal data.

3 COMMENTS AND CONCLUSIONS

The data management plan in D.10 was presented as initial guideline for data management on flexJET project.

4 ACKNOWLEDGEMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 792216.

5 REFERENCES

- [1] Grant Agreement flexJET Project – GA number: 792216, LCE-20-2016-2017
- [2] Template Horizon 2020 Data Management Plan (DMP) (http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm)
- [3] OpenAIRE. What is the Open Research Data Pilot? (<https://www.openaire.eu/what-is-the-open-research-data-pilot>) How to create a DMP Plan (<https://www.openaire.eu/opendatapilot-dmp>)
- [4] Data Management Plan (DMP) Online (<https://dmponline.dcc.ac.uk/plans>)