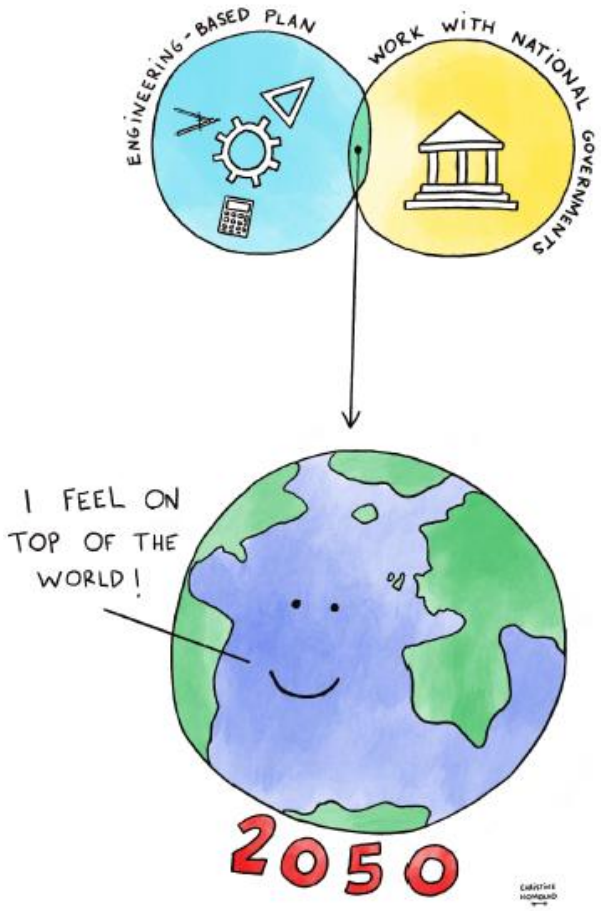
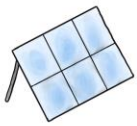
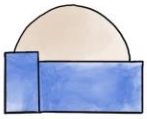
# ENERGY AND CLIMATE PLANNING TO 2050

## Phase 4 Framework




## Collaborative Planning and Global Co-operation to Engineer a Better Future






*Welcome to the Future Climate-Engineering Solutions project and our Phase 4 Framework.*

*This initiative has been running for 10 years and has been sustained by the passion of the engineers volunteering their time, knowledge and insights for the climate change challenge.*

*The focus of our leadership of the Future Climate - Engineering Solutions (FC-ES) project has been to review the previous three phases to ensure best practices are applied in Phase 4.*

*It is our intent to hold a symposium in 2018 where countries will share their energy and climate plans. Activists, governments and NGOs will be able to interact with engineers to understand the options and implications of the paths ahead.*

***Proposed by the FC-ES steering group***

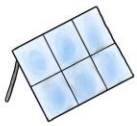
*Alexandra Howe*

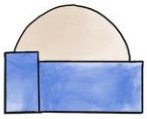
*and*

*Andy Webster*

*FC-ES Phase 4 Co-Chairs*

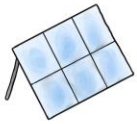
 

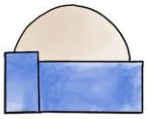










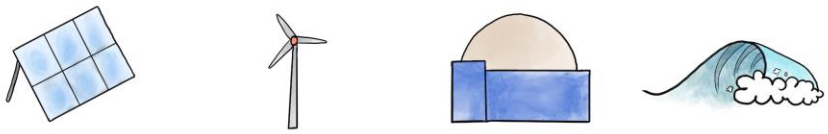

## 1. Preface

Future Climate-Engineering Solutions is a global engineering alliance working together with national governments to develop, share and implement best practice in national climate plans and energy systems.

Through this project, engineering associations from each participating country are tasked to develop an engineering-based energy and climate plan for their country for the period up to the year 2050. These plans aim to reduce the emission of greenhouse gases to a sustainable level (defined as limiting global temperature increase to 2$^{o}$C).

The energy and climate plans can be used by the associations in national public debates on energy and climate. The outputs can effectively be used in joint dissemination activities including participation in the United Nations Framework Convention on Climate Change (UNFCCC), Conference of Parties (COP) process, and other relevant conferences.

This document is intended as a guideline for the preparation of these energy and climate plans, and to ensure consistency and comparability across the national energy and climate plans of participating organisations.



## 2. Introducing the FC-ES Project

The Future Climate-Engineering Solutions (FC-ES) project aims to provide the world with proven engineering solutions that respond to climate science and policy in support of the United Nation's Nationally Determined Contributions and Sustainable Development Goals.

To achieve this, FC-ES is building a network across engineering institutions, governments and organisations that are actively involved in climate change mitigation. Within this network, engineers come together to support each other to develop national energy and climate plans that meet the UN National Development Commitments, using engineering solutions that are proven and demonstrable. These plans enable the dialogue around options to happen within a context of realism and pragmatism, ensuring that the policies translate into activities that can achieve their goal.

This initiative was triggered in 2008, ahead of the United Nations Framework Convention on Climate Change (UNFCCC's) Convention of Parties (COP) 15 held in Denmark in 2009. The Danish Society of Engineers (IDA) recognised the unique spotlight coming to their country given the historic significance of this COP event where a new Kyoto agreement was expected. They also realised that there was a gap between the climate science and the public policy that needed to be filled by engineers presenting what was practical, possible and affordable.

The project launched in 2008 with eleven countries developing country specific plans of their engineering pathways. The project was repeated in 2011 with countries updating or developing pathways relevant to them and for a third time in 2013.

This Framework Document represents the start of the fourth phase of this project with an increased global network enabling more countries to participate in initiating the engineering dialogue and designing ways to deliver on their aspirations. This Phase 4 will bring together these countries at a symposium on energy and climate plans, to help policy adjust and respond to what's needed and what's achievable.

## 3. Objectives

The objective of the overall FC-ES project is that each participating national engineering organisation should prepare a national energy and climate plan to reduce the emission of greenhouse gases to a sustainable level defined as limiting global temperature increase to 2°C.

# 4. How FC-ES Project Works

The FC-ES project is comprised of these elements:

## 4.1 Steering Group

The FC-ES project has been led by a variety of engineering groups since its inception in Denmark in 2008. The intention is that the leadership role will pass to other participating countries over time while retaining the partnership with the World Federation of Engineering Organisations (WFEO). The next handover will be after Phase 4, estimated to be at the end of 2018-2019.

## 4.2 Network of Members

FC-ES intends to develop and share best practice with the professional engineering associations of all countries. Today there are 23 member countries, but through the support of WFEO FC-ES aims to share the learning and benefits of the project with all nations of the world.

## 4.3 Framework Document

This document is the core guidance document in which best practice is recorded and shared. The key objective of the Framework Document is to ensure that all the national energy and climate plans are internally consistent and comparable, in order that the total body of work has the maximum value for realising a globally viable and sustainable energy supply and demand system. The key elements that support this objective are the Best Practice Principles (Section 5).

## 4.4 Website

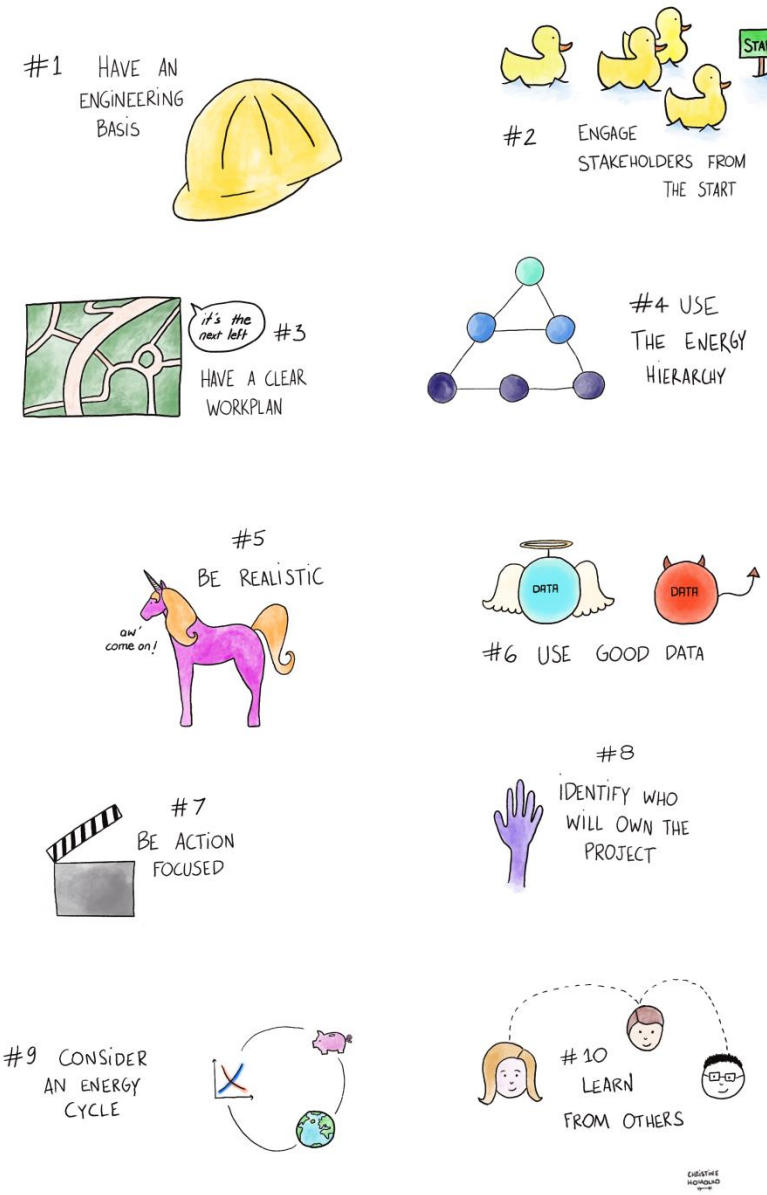
The website (www.fc-es.net) serves as the hub for sharing work.

## 5. Best Practice Principles

Since 2008, the project has learnt from the experience of creating the energy and climate plans. In preparing for Phase 4 a number of the original authors involved were interviewed by the steering group.

The FC-ES steering group has proposed these ten principles following input from those contacted and listed in Acknowledgements (Section 10);




### #1 Have an engineering basis

National energy and climate plans need to draw on sound engineering expertise rather than those based only on political goals, short-term expedience, or a particular technology.

### #2 Engage stakeholders from the start

Engagement should begin early in the project. Be clear about who the stakeholders are before embarking on the creation of a plan. Identify the key stakeholders whose input is desired, who will help put the plan together, will own it, promote it once it is complete, and help disseminate it.

### #3 Have a clear work plan

Develop a strategy for how the plan will be created; how much time will be required and what budget may be needed.

### #4 Use the energy hierarchy

Use the energy hierarchy as a framework for making design decisions about the energy system proposals, from the bullet points below in order of priority:

- Minimise demand for energy including non-technological change such as behaviour change, policy, and spatial planning;
- Increase energy efficiency and consider energy conversion technologies;
- Source energy from sustainable renewable resources;
- Having maximised the above points, use other energy supplies with associated technologies that minimise greenhouse gas emissions.

### #5 Be realistic

Develop a plan with achievable timescales. Consider what actions are needed, by whom and by when to meet the identified targets and climate change goals.

### #6 Use good data

The energy and climate plans need to be based on data from peer-reviewed sources, describing historical trends in supply and demand in supply. A part of the plan would be the creation of mechanisms to generate high-integrity data where they do not currently exist.

### #7 Be action focused

Ensure the plan strikes an appropriate balance between the focused actions needed and the background information that underpins those identified actions.

### #8 Identify who will own the project

Consider how the energy plan will be sustained beyond its completion and dissemination. Who will monitor its use, accuracy, success and compliance and ultimately take responsibility for revising the plan with what timeline?

## #9 Consider an energy cycle

A sustainable plan must not only minimise damage, but must aim to meet societal and environmental objectives, which need to be stated. These objectives will include:

- Environmental sustainability – each plan should demonstrate how to mitigate the climate change and wider environmental impacts through demand and supply side efficiencies, and supply from renewable and low carbon sources;
- Social equity – plans should consider accessible and affordable energy solutions;
- Economic security – plans should look at satisfying the supply-demand balance with an acceptably low risk of disruption. Focussing on energy demand systems allows for flexibility, diversity, and overall demand reduction.

## #10 Learn from others

The FC-ES project is as much about "how" a national energy and climate plan is created as it is about "what" goes into that plan. To ensure the optimum process of continual improvement, participants are encouraged to collaborate with and learn lessons from other organisations.

## 6. Target outputs

Each participating organisation should produce a report that describes their national energy and climate plan. Outputs need to be suitable to support the dissemination; debate; promotion of the role of engineers; lobbying of key stakeholders who have an interest in national energy and climate plans; and communication with national governments.

### 6.5. Basic project report - National Energy and Climate Plans

The "basic" report needs to contain the following:

A. A short description of the work conducted by the association, including how the plan was developed, who contributed, etc.

B. A qualitative and quantitative description of the energy system and the sources of GHG emissions, e.g. the BEIS 2050 Global Calculator. If a country has official national goals for energy and climate, these must clearly be stated.

C. Description of the most important technologies and solutions proposed for implementation towards the year 2050; characterisations of the technologies, the development status and the present and prospective diffusion within the country. This includes quantitative data regarding the diffusion of the technology, annual GHG reductions, and associated costs. Data should be provided for 2030 and 2050, as well as for baseline years.

### 6.6. Advanced project report - National Energy and Climate Plans

The "advanced" report must contain the following:

A. A short description of the work conducted by the association, including how the plan was developed, and who contributed.

B. A qualitative and quantitative description of the whole energy system including demand and supply side cost and cost savings, and the sources of GHG emissions. If a country has official national goals for energy and climate, these must clearly be stated.

C. Description of the most important technologies and non-technological solutions proposed for implementation towards the year 2050, for demand and supply; characterisations of the technologies, the development status and the present and prospective diffusion within the country. This includes quantitative data regarding the diffusion of the technology, annual GHG reductions, and associated costs. This data could be presented in a SWOT table to aid others in understanding relative strengths and weaknesses of solutions. Data should be provided for 2015, 2030 and 2050, as well as for the baseline years.

D. A qualitative and quantitative description of the total climate plan based on the technology solutions proposed. Quantitative data for 2015, 2030 and 2050, as well as the baseline year, for the energy system, need to be compiled.

E. A description of the measures that are required to support the development and diffusion of the technologies. This could include R&D; incentives which promote innovation; technology transfer incentives; Joint Implementations (JI) and Clean Development Mechanisms (CDM), subsidies, regulations, etc.

F. The scenarios of the plan need to include economic analyses and estimates of the costs of specific technologies as well as the economic viability of the climate plan proposed.

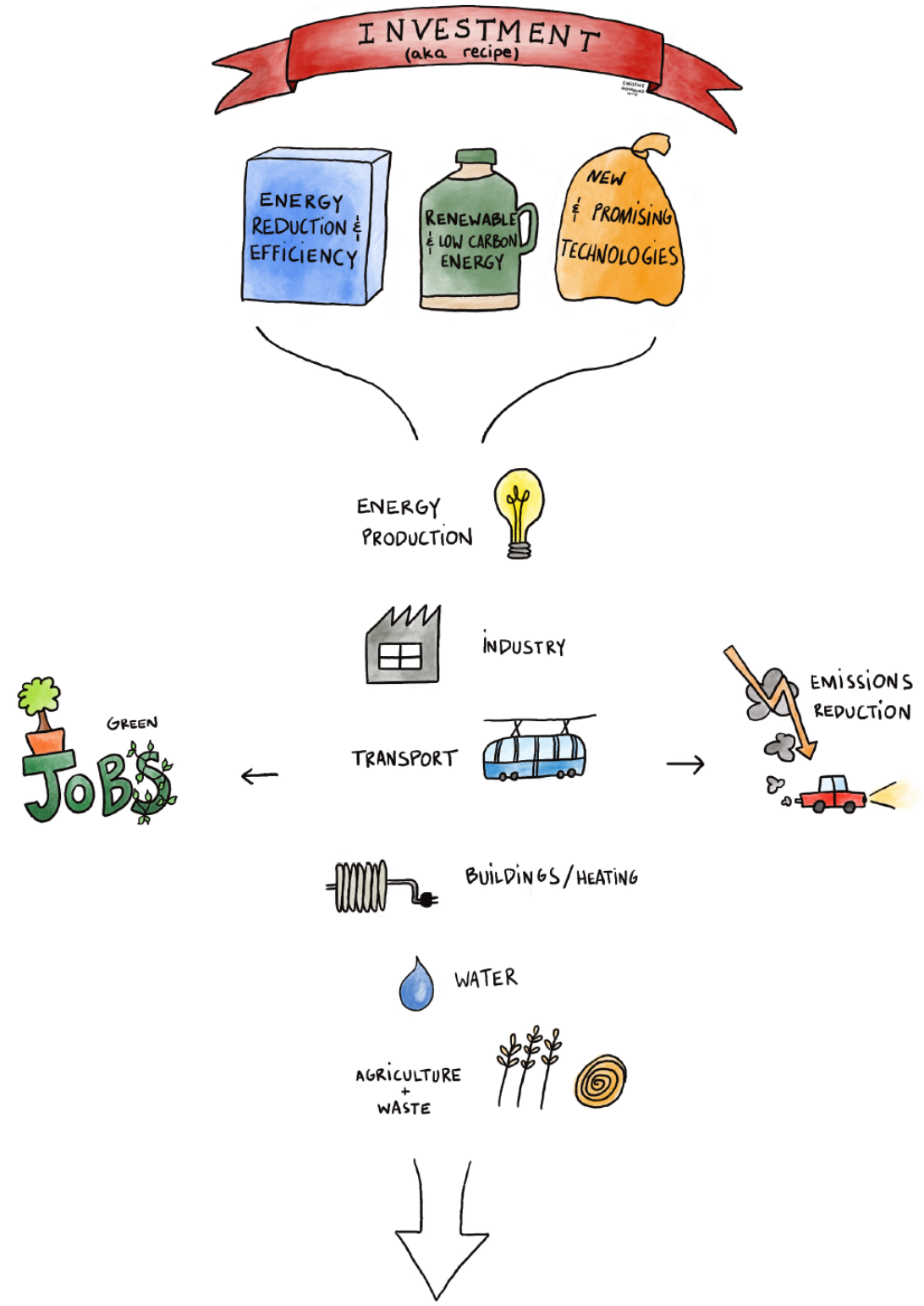
G. Security of supply issues need to be addressed in the report. The sustainable climate scenario needs to be developed based on available energy resources and without risk to sustainable food production.

H. Associations are encouraged to include a description of the national innovation, business and job creation potential of their climate plan.

Previous project participants suggested a key output of National Plans is the creation of “green jobs”.

Thus, the following model was introduced to guide the structure of each Plan:

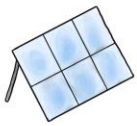


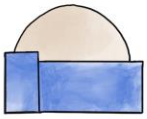
## 7. Workflow / process

The framework document defines the main timescale of Phase 4 of the project. The timing is partly dependent on the availability of resources to fund presentations at conferences.

The project proposes that initial reviews and knowledge sharing activities between parties will make maximum use of virtual knowledge sharing tools, and that face to face liaison will be used for the most important collaboration between engineering organisations and their national governments.






| Date | Action for steering group | Action for report writers |
|---|---|---|
| February 2018 | Publish Energy and Climate Planning to 2050 - Phase 4 Framework | Read Phase 4 Framework |
| February 2018 | All-Network kick-off webinar to introduce Phase 4:<br>Open to all Engineering Associations network members / new members introduced via WFEO | Join webinar |
| February 2018 | Support work on development of Energy and Climate Plans | Develop plan and recruit team to create Energy and Climate Plan |
| May 2018 | Mid-Term Review and Report:<br>Review first data and summary of main aspects provided by participating countries. | Start work on collecting data to support Energy and Climate Plan. Submit first data and summary of main aspects of Plan. |
| May - September 2018 | Feedback and comments on the mid-term report | Continued work by participating engineering associations |
| September 2018 | Review draft Energy and Climate Plans. | Submit draft Energy and Climate plans including a final data sheet |
| October 2018 | Provide feedback and comments on draft Plans. | Review comments and update Plan. |
| October 2018 | Global Engineering Congress Panel Session on Phase 4 project. | Attend Global Engineering Congress |
| December 2018 | Collate National Energy and Climate Plans and develop summary. | Submission of final Energy and Climate Plan |
| December 2018 | Presentation of Energy and Climate Plans at COP24 | Share Energy and Climate Plan with national stakeholders. |

## 8. References


- Phase 1: Danish Energy and Climate Plan 1
- Phase 2: Danish Energy and Climate Plan 2
- Phase 3: Danish Energy Vision 2050

- Phase 1: Finnish Energy and Climate Plan 1

- Phase 1: German Energy and Climate Plan 1

- Phase 1: Indian Energy and Climate Plan 1

- Phase 1: Irish Energy and Climate Plan 1

- Phase 1: Japanese Energy and Climate Plan 1

- Phase 1: Norwegian Energy and Climate Plan 1

- Phase 1: Swedish Energy and Climate Plan 1

- Phase 1: UK Energy and Climate Plan 1
- Phase 2: UK Energy and Climate Plan 2

- Phase 1: USA Energy and Climate Plan 1

- The BEIS Global Calculator

- United Nations Climate Change NDC register

## 9. About the FC-ES Steering Group

Phase 1 (2008-2009) initiated and led by Denmark (the Danish Society of Engineers, IDA) included 13 participating engineering associations, resulted in 10 national Energy and Climate plans, and the publication of a joint report. Phase 2 (2009-2011) led by the UK (the Institution of Mechanical Engineers, IMechE), resulted in 11 national Energy and Climate plans. Phase 3 (2011-2016) led by the UK (Cambridge University Engineering Department and the Global Association for Transition Engineering) led to a global network of 29 national engineering organisations including the World Federation of Engineering Organisations. This network considers the strong linkage between the national Energy and Climate plans and how they relate to the Nationally Determined Contributions submitted by the Parties of the United Nations Framework Convention on Climate Change Secretariat, in line with the Paris Agreement adopted during the Convention of Parties 21.

**Phase 4 (2016-Present) is being led by the co-chairs:**

**Co-Chairs**

- Dr Alexandra Howe, MSc, BSc, MRSB, Future Climate-Engineering Solutions
- Andy Webster, CEng, Fellow Institution of Mechanical Engineers

**Steering Group**

- Dr Alison Cooke, CEng, Fellow Institution of Mechanical Engineers
- Beatriz Fernandez, Consultant, United Nations Environment Programme
- Daniel Kenning, CEng, CEnv, FIMechE, MGATE, MEI, Chair Global Association for Transition Engineering
- Gerald Sekiti, BIct, Future Climate-Engineering Solutions
- Jacob Ohrvik-Stott, MEng, Member Institution of Chemical Engineers
- Dr Jean Venables, CBE, FREng, CEng, Fellow Institution of Civil Engineers / WFEO
- Dr Jenifer Baxter, CSci, MEI, CEng, Member Institution of Mechanical Engineers
- Lee Billingham, BEng, MSc, CEng, Fellow Institution of Mechanical Engineers
- Mark Apsey, MEng, CEng, Member Institution of Chemical Engineers
- Pernille Hagedorn-Rasmussen, MSc, The Danish Society of Engineers
- Phil Cohen, MEng, Department for Business Energy and Industrial Strategy
- Rob Curd, BA, PG Dip, Institution of Civil Engineers

## 10. Acknowledgements

**Authoring of report**

- Dr Alexandra Howe, MSc, BSc, MRSB, Future Climate-Engineering Solutions
- Andy Webster, CEng, Fellow Institution of Mechanical Engineers
- Daniel Kenning, CEng, CEnv, FIMechE, MGATE, MEI, Chair Global Association for Transition Engineering

**Interviewees for Section 5 - Best Practice**

- Dr Brian Cox, Fellow Institution of Mechanical Engineers
- Professor Brian Vad Mathiesen, Energy Planning Aalborg University
- Johan Sittenfeld, MSc, Swedish Association of Graduate Engineers
- Professor Emeritus Doug Crawford Brown, University of North Carolina and University of Cambridge.
- Professor Jim Skea, CBE, FRSA, FEI, HonFSE, Imperial College London

**Illustrations**

- Christine Homolko, https://linkedin.com/in/christinehomolko

**Copywriting**

- Chris Johnston, MSc, PIEMA, https://www.linkedin.com/in/chris-johnston-consultant/
- Evelyn Asher, MBA, Communication Coach, https://linkedin.com/in/evelynasher/
- Nicole Johnston, Writer, Communications & Policy Consultant, https://www.linkedin.com/in/nicole-johnston-communications/