BUROHAPPOLD ENGINEERING

A WHITE PAPER

ENERGY ISLAND

EXPLORE

CONTENTS

1. EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

We see the concept of an 'Energy Island' as a key tool for shifting to a globally sustainable energy system, by galvanising local action. We have developed an interactive approach to creating an Energy Island, which can be applied in many contexts around the world. To start with, we have tested it on the ground in Cornwall. The outcomes of this Cornwall Energy Island project are described in detail here.

Energy is essential to provide our daily needs and power economic activity. However, our current energy systems are primarily fossil fuel based, contributing to 50% of global GHG emissions. Fossil fuel energy could become more expensive, as we turn to inaccessible resources such as tar sands and shale gas. Many places are reliant on imported energy, often from far away. This leads to a flow of wealth out of the local economy, as well as reduced resilience.

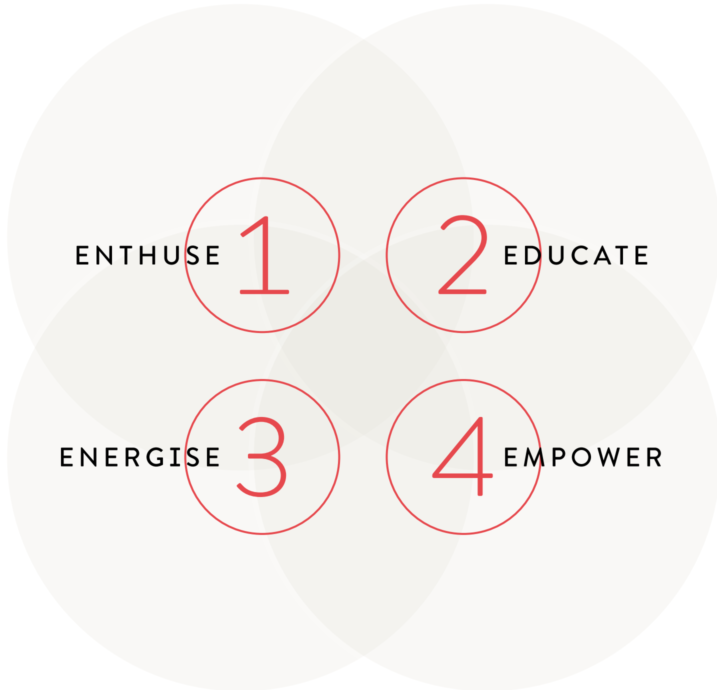
These dynamics are particularly visible in islands, and the technical constraints that isolated land areas face are often met with ingenuity and innovation.

We wanted to explore how island thinking can promote creativity in a context which is not quite an island - the peninsula of Cornwall. As an example of an 'island' connected to the 'mainland', the learning from the Cornwall context can be transferred both to mainland situations and to true islands.

To develop an Energy Island project in Cornwall, we set up a self-funded partnership with the Eden Project, and worked closely with the Local Enterprise Partnership (LEP), Cornwall Council and others. We provided a neutral platform for local people to explore the future of Cornwall's energy landscape, in a two-day workshop held at the Eden Project in March 2015. By using the Energy Island metaphor, Cornwall can improve its economy by becoming self-sufficient in energy and exporting surplus to the 'mainland'.

Our Energy Island approach involves four steps: enthusing participants through keynote speeches; educating through knowledge sharing; energising through power games; and empowering through the call to action.

This executive summary summarises the key outcomes of each of these four steps in Cornwall. The main body of the report gives more background on why we chose Cornwall as a case study, and the detail of each of the steps in the Energy Island process.



1 ENTHUSE: KEYNOTE SPEECHES

The first step involves getting participants excited about the challenge ahead by introducing the context, issues and opportunities through the eyes of inspirational people in positions of power and influence.

In Cornwall, the tone and level of ambition was set by inspiring speeches from Roger Nickells, CEO of BuroHappold, Sir Tim Smit, executive vice chairman and co-founder of the Eden Project, Chris Pomfret, Chair of the Cornwall and Isles of Scilly Local Enterprise Partnership, Steven Ford, Future Economy Programme Lead at Cornwall Council, Catherine Mitchell, Professor of Energy Policy at Exeter University and Hugh Montgomery, Professor of Intensive Medicine at University College London.

2 EDUCATE: INFOBURSTS

In the second step, short speeches and presentations give participants knowledge and key insights from experts into social, political, technical, environmental and economic perspectives. This informs and elevates the dialogue and decision-making in the interactive elements of the workshop.

In the workshop in Cornwall, a range of experts gave a series of technical briefings on nine themes:

- Private Sector Investment
- Community Ownership
- Game Changing Technologies
- Energy Efficiency, Retrofit and Fuel Poverty
- Balancing the Grid
- The Size of the Prize
- Transport
- National Policy and Regulation
- Landscape, Heritage and Environmental Impacts

3 ENERGISE: POWER GAMES

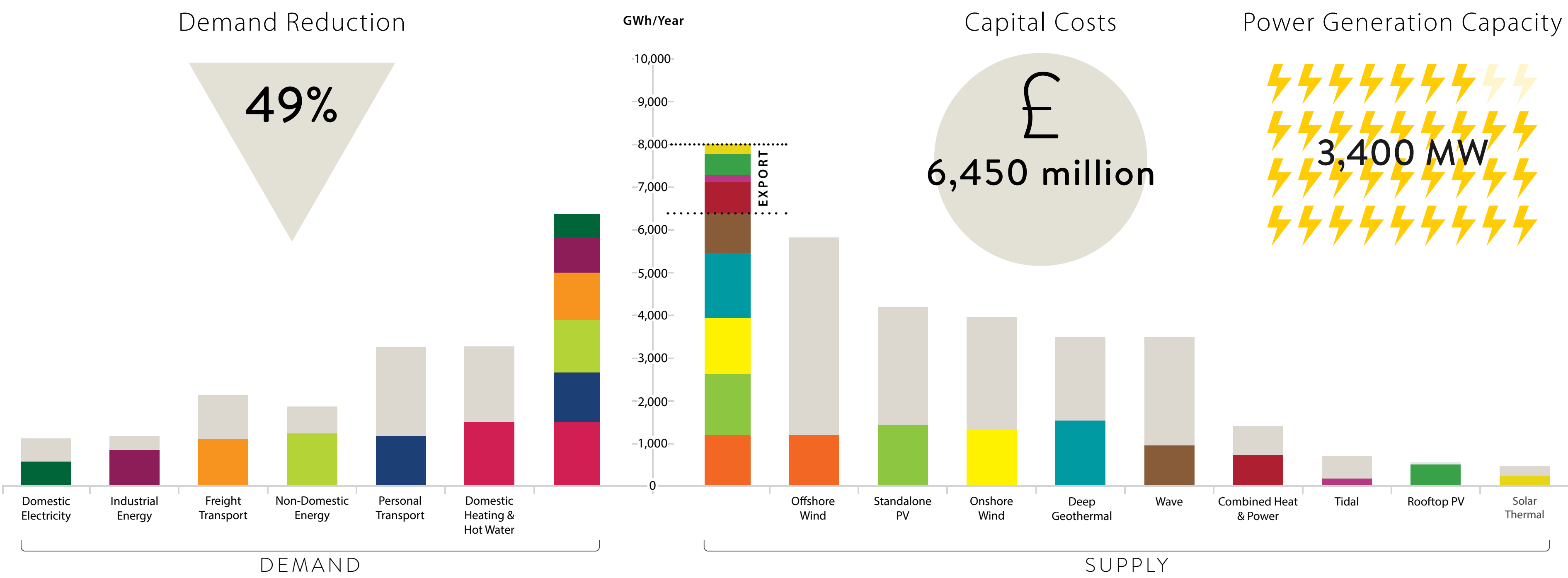
The Power Games workshop challenges participants to create an energy scenario for Cornwall where energy supply and demand are balanced. It provides participants with the structure and information to be actively engaged and test different scenarios. This informs discussion and allows us to identify where there is agreement and disagreement over what should be done.

The Power Games session in Cornwall achieved general agreement to reduce 2030 demand by approximately 50% and increase supply to exceed demand by 30%. This would lead to a net export opportunity. The consensus from the workshop was that this was a new and key finding, and an early indication of Cornwall's desire to control more of its energy infrastructure and to help the UK by exporting excess energy.

The data from the Power Games session was fed back to participants the next day, and fed into the Call to Action session, which focused on understanding the barriers and drivers to achieving this objective, and identifying actions to be taken.

The diagram below summarises the average scenario selected by the groups, for the whole of Cornwall. On the demand side, the grey bars show business as usual demand, and the coloured bars show the reduced demands selected by participants. On the supply side, the grey bars show the total technical potential for that technology and the coloured bars show the average level of generation selected by participants.

Rollover the vertical bars along the bottom of the diagram to see the statistics relating to each supply and demand technology.



4 EMPOWER: SUMMARY OF KEY ACTIONS

In the final step, the results of the Power Games are discussed and participants are asked to consider the current strengths and barriers of the region in moving towards potential solutions. They are then asked to define key actions to build on the strengths and remove the barriers. These actions are then prioritised based on ease of implementation and impact.

Seven key high priority actions were condensed from the participants' input at the workshop in Cornwall:

1. Create a powerful vision for a Cornwall Energy Island future:
Stories are powerful, and this story should be told consistently by Cornwall Council, the LEP, community energy groups, businesses investing in the region, and others, in the media and through publications and public speaking opportunities.

2. Build on the strength of coordinated leadership:
There are many people leading the creation of Cornwall's energy future. The involvement of a diversity of stakeholders, and the distributed nature of leadership is a strength, but greater data sharing and coordination would be valuable. Coordination activities should be valued and resourced.

3. Infrastructure planning:
Develop a detailed understanding of a future energy system in Cornwall to incorporate demand, generation and distribution. This study will inform a strategic plan alongside detailed research into the future management of these systems such as funding, legislation and ownership of electricity, gas, heat to address the issues of the status quo.

4. Train, attract and retain more skilled workers
Through education, increased wages and better public transport.

5. Just do it:
Develop a series of projects which support the actions above and help to deliver project-based progress within Cornwall.

6. Provide funding and finance to projects:
Ensure availability of development funding, address the cost of capital, interest levels on loans, and support small projects to access larger pots of funding through aggregation.

7. Policy and regulation reform:
Identify the ways in which policy and regulation blocks the Energy Island vision and find solutions.

The Vision

These seven actions take us along the journey towards *harnessing Cornwall's renewable resources to halve energy costs and double new jobs by 2030*.

2. INTRODUCTION

INTRODUCTION

We see the concept of the 'Energy Island' as a key tool for shifting to a globally sustainable energy system. The thought experiment of energy independence or islandness challenges us to design a system which can produce its basic needs internally, a constraint which prompts creative innovation, and frames the problem in a stimulating way.

Gavin Thompson
Head of Energy Consulting
BuroHappold Engineering

To understand this more deeply and ground the work in a locally specific context, we worked with the Eden Project to invite a wide range of stakeholders to participate in an energy island thought experiment with us, with a focus on the peninsula of Cornwall in the South West of the UK. This process has yielded a number of insights which are of value to local stakeholders in Cornwall, and which also have a much wider applicability for other parts of the UK and the world, whether these are true islands, remote locations, or highly connected urban centres where the concept of an Energy Island can reveal a need for increased local resilience. This white paper aims to share these insights, and the approach we have taken to developing the Energy Island concept. We hope that you will find it of interest to you wherever you are, and would be keen to hear about how these ideas resonate and are meaningful in other contexts, so do get in touch.

Energy is an essential resource in all of our lives, providing for our daily needs as well as powering economic activity. At the same time, our energy systems are deeply linked with climate change – around 50% of global Greenhouse Gas emissions are caused by energy production for heat, electricity and transport[1]. Not only are fossil fuels destabilising the climate, they could also become more expensive, as the most accessible global resources are running out and we turn to 'extreme energy' sources such as tar sands, Arctic oil and shale gas.

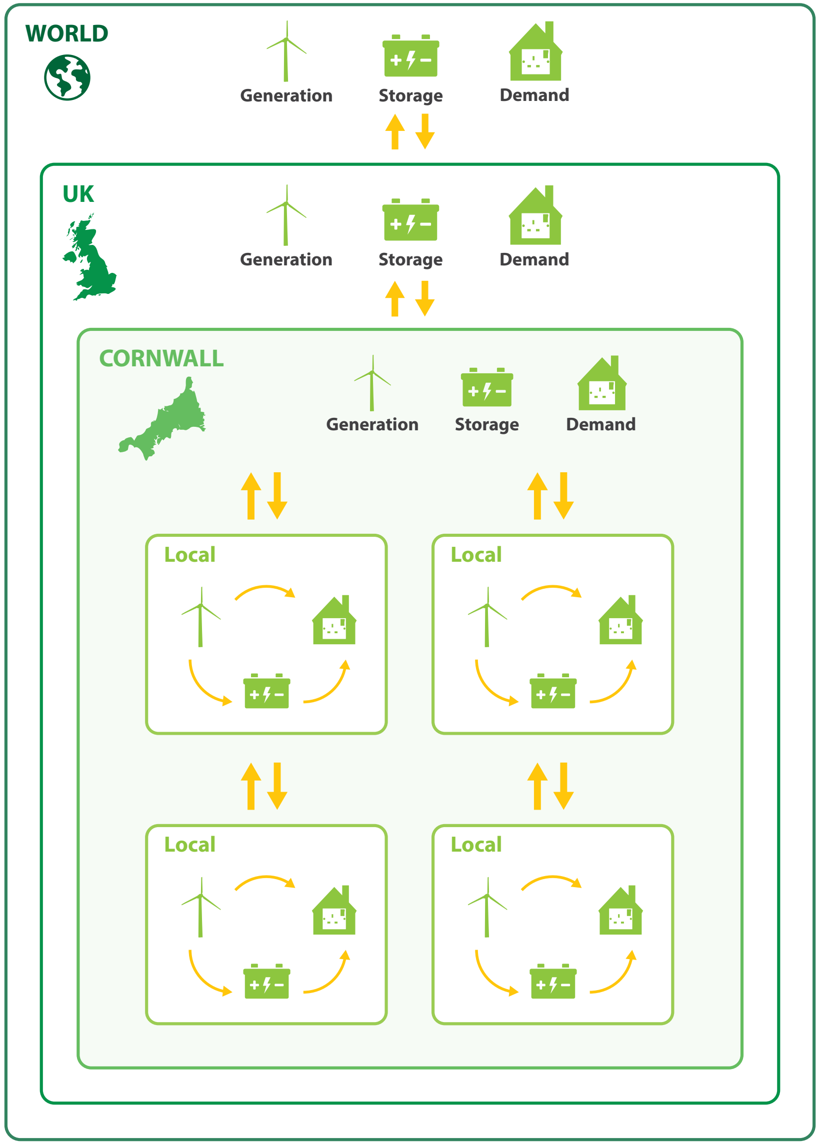
Many places are reliant on primary energy imported from other parts of the world. This is a major economic 'leaky bucket' as wealth flows out to purchase energy, and doesn't come back. However, places that are currently importing fossil fuels often have a rich local sustainable energy resource, which could be harnessed to provide local energy needs, reduce dependency on imported energy, create local jobs, and contribute to global climate change mitigation.

'Islandness'

Islands have specific characteristics which help us to see these dynamics more clearly. They often face technical constraints – electrical connections to the mainland are limited or non-existent, and the cost of increasing their capacity can be prohibitive, and the cost of importing fuels is high. Economic flows in and out of an island can be more easily identified than those in mainland communities. As Sir Tim Smit notes in his keynote (page 18), humans need boundaries, and island thinking gives us this. It is easier for an island to have a human scale sense of identity, to have a simpler governance structure that can get on with doing things without getting bogged down in political processes. Island communities often have a culture of local resilience and self-sufficiency, born of necessity. There has been much energy innovation coming from islands in recent years. Examples include: active network management and demand response experiments in Orkney, Shetland and Eigg where the mainland electricity grid connection is an important constraint; combined wind and solar PV generation on Pellworm off the North East coast of Germany; and a 100% renewable energy plan for El Hierro, part of Spain's Canary Islands. The innovation taking place in these islands is often transferable to other locations where the need is less pressing, and the expertise developed in islands can provide a source of economic value for island nations.

1 Another 19% come from industry, including energy and process emissions. Data from 2004, CO_2 equivalent, IPPC www.ipcc.ch/publications_and_data/ar4/syr/en/figure-spm-3.html

Energy Island as a permeable, nested system.

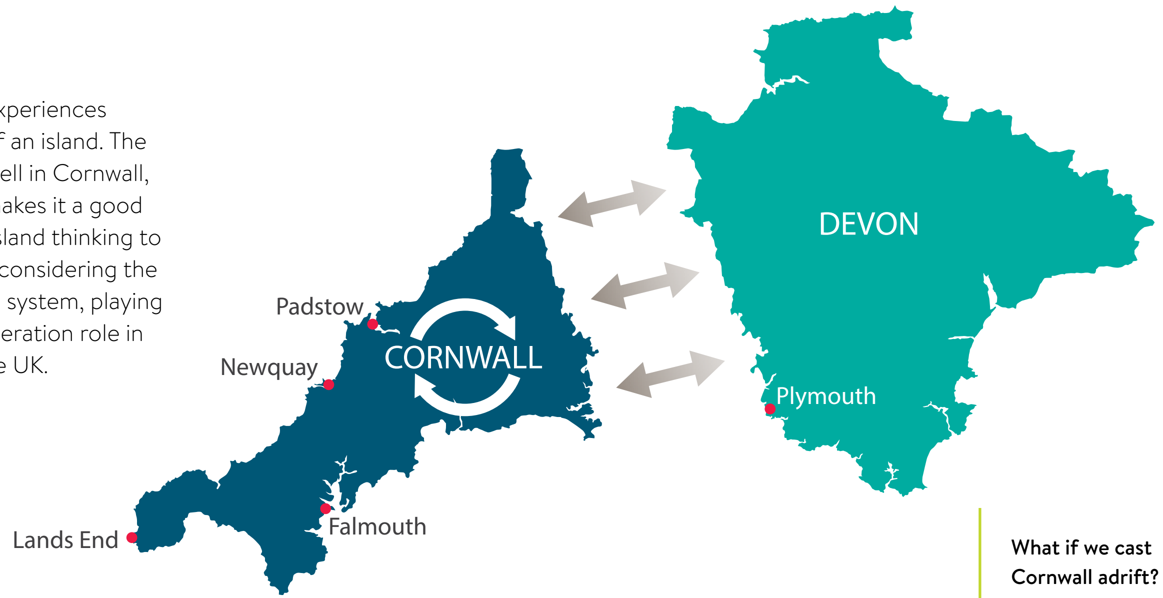


Humans need boundaries, but these boundaries can also be permeable. An island can be connected to the mainland, a peninsula or a city can be treated as an island within an island. Electricity flows through interconnectors, and with island thinking we aim to minimise this flow, or to time it in such a way as to provide maximum economic value for the island itself. When we think of an Energy Island as a nested system, with governance and infrastructure boundaries aligned with each other, the local, regional, national and global systems each play their role.

As engineers, we draw on knowledge of universally applicable principles, but know that with design, the devil is in the detail, and the detail is contextually specific. The learning comes when we try to do something and experience the challenges this throws up. We wanted to offer something useful to a real situation, and learn from the real world messiness of this experience. We understand many aspects of energy transitions from a technical and economic perspective: minimising energy demands of buildings and cities, maximising opportunities for urban renewable energy generation, seeing how energy, water and waste infrastructures can be integrated to achieve radical increases in resource efficiency. We also have an understanding of the economics – return on investment of different options, developing financial models and modelling local economic impact. But achieving transitions in existing systems is also socially complex, and requires a shared vision and coordinated activity from a wide range of stakeholders. This is why we decided to set up a self-funded partnership with the Eden Project in Cornwall to explore the idea of an Energy Island for Cornwall, and create a vision to be shared with a wide range of stakeholders. To do this, we hosted a two-day Energy Island event at the Eden Project in March 2015.

Why Cornwall?

Cornwall is rich in renewable resources, with the highest levels of solar irradiation of the UK, and good potential for marine energy from the Atlantic. The local governance structure is relatively simple, with only two Unitary Authorities, Cornwall and the Isles of Scilly, both covered by one Local Enterprise Partnership. Cornwall has a history of independence and a strong cultural identity, with Cornish as a second official language. This independence was recognised in July 2015 with a Devolution Deal for Cornwall. The low population density and dispersed settlement pattern provides both challenges and opportunities: space for onshore renewables such as wind and solar farms, high levels of fuel poverty and off gas properties with substantial room for improvement, and difficult public transport provision. During the Cornwall Energy Island event, the electricity distribution network operator, Western Power Distribution, announced that the distribution network in Cornwall is full, and will need substantial investment before new renewable energy connections can be permitted. The Cornish peninsula is in many ways remote from the rest of the UK, and although it is not a true island, it experiences may of the constraints of an island. The island metaphor works well in Cornwall, and its connectedness makes it a good case study for applying island thinking to mainland situations, and considering the island as part of a nested system, playing an important energy generation role in relation to the rest of the UK.



What if we cast Cornwall adrift?

This white paper explains our Energy Island approach, and its outcomes for the Cornwall case study. The results detailed here are primarily for the people of Cornwall, but the approach can be applied in other contexts to engage a diversity of stakeholders in our energy transition. We want to share this as a case study for all those involved in energy transitions globally, to allow the debate (and ACTION) to move forward.

3. ENERGY ISLAND: OUR APPROACH

HOW DO YOU ENGAGE EXPERTS AND COMMUNITY IN THE DEBATE?

ENTHUSE

Keynote speeches

This involves getting participants excited about the challenge ahead through introducing the context, issues and opportunities through the eyes of inspirational people with expertise, power and influence.

EDUCATE

Infobursts

Through short speeches and presentations participants are given knowledge and key insights from experts into social, political, technical, environmental and economic perspectives. This informs and elevates the dialogue and decision-making in the interactive elements of the workshop.

ENERGISE

Power Games

Providing participants with the structure and information to be actively engaged and test different scenarios to address the problem. It informs discussion and allows us to identify where there is agreement and disagreement over what should be done.

EMPOWER

Call to Action

The results of Power Games are discussed and participants asked to consider the current strengths and weaknesses of the region in moving towards potential solutions. They are then asked to defines clear actions and owners, and assess them for positive impact and ease of implementation.

The challenge of achieving a transition to a more sustainable energy future, and realising the social and economic benefits, is at least as much of a social challenge as a technical challenge. Experts, policy makers, decision makers, engineers, community groups, and politicians all need to be engaged in the debate to design, fund and advocate the solutions that will enable this. This requires exploring scenarios and developing action plans collaboratively. In order to do this we developed and tested a robust methodology that allowed the conversation to be progressive, informed and action orientated. The four stage process enthuses participants; integrates expert technical knowledge and context specific information; allows an informed dialogue and debate in the development of possible energy scenarios; and finally defines tangible actions for a region.

This approach was developed over several months and iterations, with feedback from local stakeholders and bringing in well researched information to inform the debate. The robustness of the Energy Island approach to deal with the messiness of reality has been tested in Cornwall but we believe the approach is globally applicable. The next few pages show the scenarios developed and specific actions that emerged from the workshop which are relevant to Cornwall. However, some of the learning can be applied broadly and the approach can be used globally.

4. CORNWALL CASE STUDY

INTRODUCTION

To develop an Energy Island project for Cornwall, we set up a self-funded partnership with the Eden Project, and worked closely with the LEP, Cornwall Council and others. We provided a neutral platform for local people to explore the future of Cornwall's energy landscape.

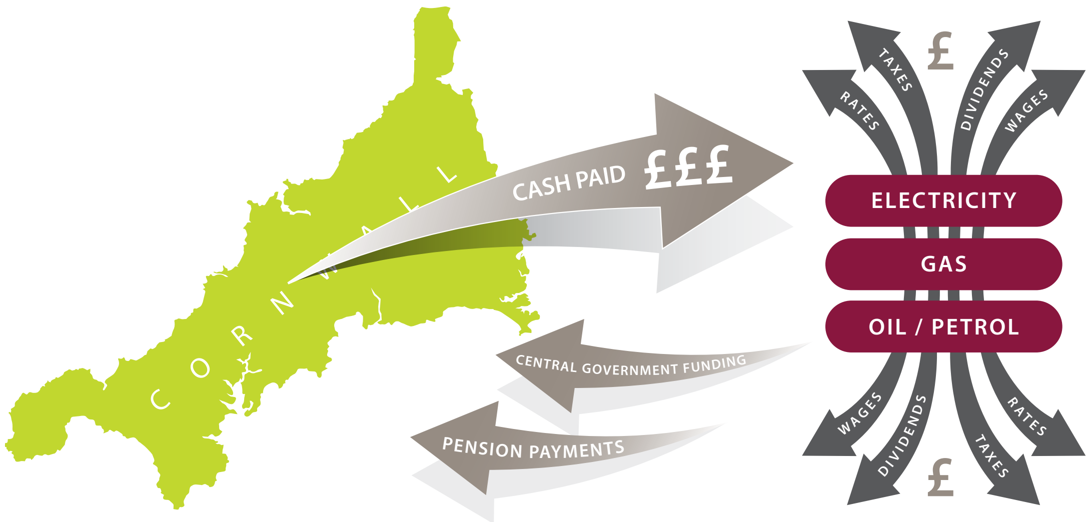
This section of the white paper describes the way the Energy Island approach was applied in Cornwall, and the outcomes of the Cornwall Energy Island case study. This includes an understanding of the locally specific strengths and barriers to achieving an Energy Island vision, and a summary of key actions that would move the agenda forward.

Adapting the existing energy system is the key to Cornwall becoming richer: generating more, consuming less and selling the excess. This can lead to more jobs, higher wages, better health, more educational opportunities and a lighter carbon footprint.

Annually, £1bn leaves Cornwall in energy payments which represents nearly 15% of the total Cornish economy. The resources, technology and finance exist to transition from a centralised system to a local, renewable, distributed and demand responsive system. This approach will also make Cornwall a trailblazer for the UK.

Cornwall has embraced renewable energy faster than elsewhere in the UK, with strong strategic frameworks in place from Cornwall Council and the LEP, and delivery by a wide range of partners. This bottom-up 'patchwork' approach is impressive but faces limitations. The Cornish electricity grid is now at capacity: there is no space for new renewable energy generation to connect. If new infrastructural capacity is to be released, top-down 'clockwork' and end-to-end coordinated intervention is required to maximise the benefits to Cornwall's economy. The political will exists but it needs a clear starting point and strong leadership. An Energy Island project is an excellent way to find that starting point.

Energy spending currently flows out of Cornwall



We invited a large cross section of the community to a two day workshop held in March 2015, to build on available information and our background research to create a plan of action for an Energy Island for Cornwall.

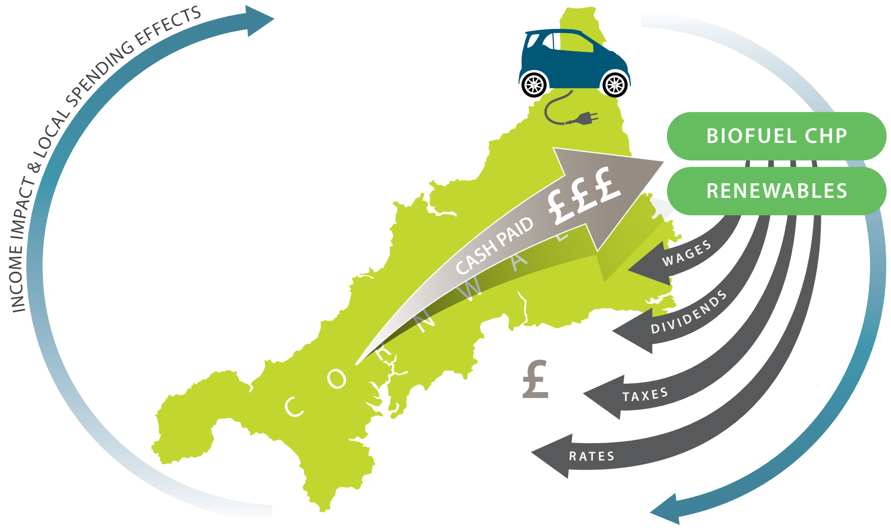
The workshop was attended by approximately 100 participants, from a variety of backgrounds and perspectives. Participants were invited based on their interest and influence in energy issues in Cornwall. The content reported on here reflects the views and contributions of workshop participants. These views are of course subjective, as no perspective on how to create change in the future will be entirely accurate.

The material coming out of this workshop was very rich, with a wide variety of excellent ideas in many areas. The discussion was lively, and no doubt many more good ideas would come out if the exercise was repeated or given more time.

We believe that our approach of bringing people together to explore the issues from their perspective, and asking what they think is a powerful one.

Over the following pages we will explain how we applied the Energy Island approach, of enthuse, educate, energise and empower, in Cornwall.

An Energy Island can help retain energy spending in the local economy.



ENTHUSE

Keynote Speeches

The event started with inspiring keynote speeches from Sir Tim Smit, executive vice chairman and co-founder of the Eden Project; Chris Pomfret, Chair of the Cornwall and Isles of Scilly Local Enterprise Partnership; Steven Ford, Future Economy Programme Lead at Cornwall Council and Roger Nickells, CEO of BuroHappold. This set the tone and level of ambition.

SIR TIM SMIT

EXECUTIVE VICE CHAIRMAN AND CO-FOUNDER OF THE EDEN PROJECT

Imagine what it must be like to be Iraqi, Egyptian or from Nicaragua or from Guatemala or Mexico, or indeed bits of Norway. Places that once had civilisations, places that were once so arrogant that they assumed they would forever be at the forefront and now are but a poor shadow of their past. Britain too is a country that was once great. Now we use words like cutting edge, bleeding edge, thinking outside of the box, thinking the unthinkable, but are we really going anywhere, do we really recognise what bravery is?

One of the real dangers of an accountancy age where everything is audited is that you don't measure like with like. We have already agreed what we are doing is poisonous so why are we using what is as the benchmark against what the future should look like?

The Energy Island is more than just a story, just a narrative of how we might fix Cornwall. There is a reason why we chose this location for the Eden Project. I visited every single pit in Devon and Cornwall, looking for a place that felt as it if was a hit record. As if it had the kind of feng shui that you need. The moment I saw this one I knew this was right, because it had a boundary. A geography. Humans are strange. We need a geography in which we feel comfortable, in which we feel we can make defences and go out from. And this was just such a place. I think the notion that Cornwall is an island is very helpful for that reason. It becomes a metaphor that we work in real time but which becomes a narrative that you can hold on to.

The Cornwall Energy Island discussion that took place at the Eden Project is in the national interest. Not only is it foolish for an island nation to depend on things from outside its shores for its security, but there is also the huge opportunity, if we can be brave enough to get something together that works, to really offer something to the rest of the world. The potential benefits for UK PLC, and the philosophy of Britain as a nation are enormous. This can help us prove that we do not want to go palely into our decline. We actually have a bit more to give.

> "Not only is it foolish for an island nation to depend on things from outside its shores for its security, but there is also the huge opportunity, if we can be brave enough to get something together that works, to really offer something to the rest of the world."
>
> **Sir Tim Smit**

CHRIS POMFRET

CHAIR OF THE CORNWALL AND ISLES OF SCILLY LOCAL ENTERPRISE PARTNERSHIP

Eighteen months ago, I had a conversation that was foundational to what we are doing here with Hugh Montgomery, Professor of Intensive Medicine at UCH. We discussed what we could and couldn't do in Cornwall and IoS, and how we can make this bigger than what we've talked about so far.

Holding this event at the Eden Project is appropriate. Eden has said something about Cornwall and IoS to the outside world, and become an icon for today's Cornwall which is continuing the heritage of innovation and change, not just a place where the middle classes come for holidays. There's no reason why the Energy Island can't become an icon for Cornwall and IoS as Eden is today.

Cornwall and IoS has lots of relevant renewable energy resources: it is the sunniest county in the country, sits on a granite batholith with higher geothermal potential than many areas, and is home to two wave power testing facilities, as well as having wind and tidal resources. There is also an opportunity to contribute to carbon management, as Cornwall Council will oversee the development of 47,000 new houses over the next 10-15 years, which can be built to high energy efficiency standards.

The LEP was set up in 2011 as a business led organisation, part of a central government initiative to delegate decision making on economic growth to the business community in each local area. It was also decided that EU funding should be spent through the LEP strategy, and Cornwall and IoS has 600million Euros plus match funding from the Growth Deal, a total of £1bn to spend in the next 4.5 years.

Decision making in the Cornwall and IoS LEP is easier than in many parts of the UK, with only two Unitary Authorities, and a shared vision. This means that we can get beyond discussion and arguments about strategy, and talk about what we're going to do and how we're going to go forward. As Tim Smit says, it is very easy to talk about innovation. Let's stop talking, and get on with it.

> "We can do this if we have the will to make it happen, and we can ensure that the next stages don't take another 18 months."
>
> **Chris Pomfret**

STEVEN FORD

FUTURE ECONOMY PROGRAMME LEAD AT CORNWALL COUNCIL

We're on a journey. And it's a journey that to a large extent is in our own hands. There's nothing really that we can't achieve at a local level to be highly successful. And whether that's from an economic perspective, an environmental perspective, or a social perspective, it's within our grasp and within our remit and wit to get things done. In the next four to five years we absolutely have to start looking at what we can deliver, rather than just talking about it.

So where are we now? We have achieved some good things. We have a revolving loan fund for community owned renewable energy projects. We have 465MW of renewable generation in Cornwall, which provides for approximately 25% of our power needs, but 80% of the revenues are still leaving the county. There will soon be 42 electric vehicle charging points throughout Cornwall and Devon through the Drive EV project, and a collaboration with British Gas around energy efficiency in Cornish housing stock recently passed the 1500 mark. There's a whole range of projects that have taken off, but they're relatively small scale, and they were building the foundations for where we want to move on to next.

Key priority areas going forward are offshore renewables, making the most of our test facilities; deep geothermal, where we've got 60% of the UK's geothermal resource in Cornwall; and grid capacity including storage solutions, which is being addressed in discussion with Western Power Distribution and Ofgem.

There are lots of very motivated community groups, including high profile groups such as WREN and Low Carbon Laddock, as well as many others. They have difficulty with resourcing, and with getting projects investor ready. A lot of the pieces of the jigsaw are there, but how do we bring it all together in a meaningful way where we can start localising benefit and getting action on the ground?

The future economy programme will deliver infrastructure development, funding, and creating demonstrators and early adopters to take new technology through the valley of death. Ultimately, we would like to see a local energy market. It's the same vernacular as food. You produce it locally, you consume it locally, it's not that difficult to start to get that psychological movement towards what a local energy market might do for Cornwall and other areas as well, and make this mainstream.

We now have the structures in place, and it's time to look at delivery. It is a journey, but I think that it's within our power to get things to happen in a meaningful way in the next four or five years. The time is now.

> "It is a journey, but I think that it's within our power to get things to happen in a meaningful way in the next four or five years. The time is now".
>
> **Steven Ford**

ROGER NICKELLS

CEO BUROHAPPOLD ENGINEERING

We're at a crossroads: we've got climate challenges, resilience challenges and challenges with cost models. That sounds like an engineering problem, and it is. We're fascinated by what we can do using an engineering mindset, to start to drive change.

In the current energy system, we have power stations running all the time but not being used, available as 'spinning reserve' just in case we need it. Surely we can find a way of aligning electricity demand more closely with supply, and reducing this wastage.

The big change that has happened is data. A modern crowd is not just a crowd any more, it's a rich source of data. Everyone has mobile phones, tweeting, telling the world where they are, telling the world how they feel. We can read that data, it's a source of information. And it's instant. It's a fascinating opportunity to read and generate reactions that are instant.

Smart thermostats are changing the nature and availability of data in our homes too. They are communicating constantly about what's going on, giving you information as the end user, and connecting the the consumer to the generation. Suddenly you have a whole bunch of people instantly connected to the outcomes. This data enables us to do things that are really powerful, and to drive major change in a world environment, rather than just go one step at a time.

Schumpeter's waves of innovation show us an image of innovation that takes place one step at a time, then suddenly something happens that drives radical change. We want to try to find the things that drive radical change, and that is why we developed the Energy Island approach. Essentially we're playing a big game of *Where's Wally*. And the interesting thing about *Where's Wally* is that once you find the answer, you can't not find it. The purpose of the Energy Island approach is to find the simple high impact solutions in a complex context; to try to find Wally.

What are the things that are going to drive real change in this conversation? We can't imagine that, as engineers on our own. But by bringing together the thinking, intellect and experience of a wide range of stakeholders, we can assemble the things that we think are the tipping points, we can debate those things, and we can agree. And once we've found them, we can start to do something about it.

Remember the events in May 2012, when the Olympics were going to be a disaster – nothing was going to work: The transportation networks weren't going to work. The accommodation wasn't going to work. But actually it was a great success, and in part because people wouldn't accept everybody saying 'no, it's not going to work' – they intervened. This created the humanising conversation around all of the other things that turned it into a fantastic success. So if there's anything that starts to bring you into a position of negativity as you step through the Energy Island approach, think back to this. The negative stuff won't get it done. We have to stay positive and we have to stay human, and that's why we're here, to lift and engage and drive that thinking and take us forward.

Why are we interested in doing this in Cornwall? Cornwall, conceptualised as an 'island', has a simpler governance system, and so much natural energy resource. It's a fantastic place to start.

EDUCATE

Infobursts

The infobursts brought in a range of experts to give a series of technical briefings on the following nine themes: Private Sector Investment; Community Ownership ;Game Changing Technologies; Energy Efficiency, Retrofit and Fuel Poverty; Balancing the Grid; The Size of the Prize; Transport; National Policy and Regulation; Landscape, Heritage and Environmental Impacts

INFOBURSTS

In order to bring expert knowledge and contextual information into the development of scenarios, a number of experts were asked to give a range of 'infoburst' presentations to participants of the workshop. These were short summaries of the key issues with regards to various aspects of the energy system. Participants from the different groups were encouraged to attend three of the nine 'infobursts' that ran in three parallel streams, and bring back the knowledge acquired to their groups. This knowledge then fed into the development of energy scenarios and definition of actions in the following workshop sessions.

Click an individual speaker's portrait to see their presentation (if available).

Private Sector Investment:

How do you attract money to finanace renewable generation and keep the benefits locally?

Peter Bance
CEO
Origami Energy

Mike Mason
Chairman
Tropical Power

Mark Holmes
Business Development Manager
KEO energyshare

Community Ownership:

What could a really ambitious community energy sector achieve and how?

Emilia Melville
Research Engineer
BuroHappold Engineering

Neil Farringdon
Technical Director
Community Power Cornwall

Dan Nicholls
Principal Development Officer
Cornwall Council

Game Changing Technologies:

What are the opportunities and risks of innovative generation, storage and smart meters?

Tony Bennett
Operations Manager
EGS Energy

Stuart Herbet
Commercial Director
Wave Hub

Charles Purkess
Marketing and PR Manager
ITM Power (hydrogen)

Energy Efficiency, Retrofit and Fuel Poverty:

How can building fabric improvements lead to warmer healthier buildings for all?

Mark Wray
Lead Technologist
Innovate UK

Andrew Richards
Advice Team Leader
Cornwall Council

Dr Mark Dowson
Senior Sustainability Engineer
BuroHappold Engineering

Mike Moseley
Commercial Manager
Rehau

Balancing the Grid:

What are the implications of an energy island for performance of the gas and electricity distribution networks?

Luke Wainwright
Electricity Customer Manager
National Grid

Nikola Gargov
Power System Engineer
National Grid

Nigel Turvey
Design & Development Manager
Western Power Distribution

The Size of the Prize:

What are the potential social and economic benefits of not following business as usual?

Jim Coleman
Head of Economics
BuroHappold Engineering

Steven Frankel
Board Member
LNP

Transport:

How does the transport system need to change to achieve an energy island and what opportunities does this present?

Ben Simpson
Low Carbon Executive
Cornwall Development Company

Matt Trevaskis
Director
Ecodrive

Nick Helps
Associate
BuroHappold Engineering

National Policy and Regulation:

How does national energy policy and regulation enable and create barriers and opportunities to local sustainable energy development?

Dr Stephen Bass
Head of Sustainable Energy Policy
OFGEM

Shane Fudge
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Landscape, Heritage and Environmental Impacts:

What are the visual, cultural and ecosystem impacts of energy efficiency and renewable energy options?

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ENERGISE

Power Games

The aim of Power Games was to find a way to supply enough energy through renewable technologies to meet Cornwall's demand in 2030. Participants had to decide how to reduce demand and increase supply to do this. This provided a technical grounding for the discussion of social, economic, political and environmental factors that really matter.

POWER GAMES: APPROACH

The Power Games session was split into two stages as follows:

Stage 1 – Individual

This session asked participants to explore how to reduce energy demand and increase renewable energy supply through individuals considering their house, their car, their workplace and their lifestyle. The aim was to allow participants to explore their own preferences and how different choices would impact on them personally.

Stage 2 – Group scenario

This stage asked participants to think about Cornwall as a whole – what would work, on average and for everyone? The aim was to reach consensus on an agreed scenario and identify areas of agreement and disagreement.

To inform decision making participants were given information on:

- The relative costs of each option
- The associated impacts in terms of land and sea area required
- The difficulty of each option.

Details of the scenarios created in both the individual and the group sessions were recorded, and analysed immediately after the session in order to inform the 'Call to Action' workshop on the following day.

Data and Assumptions

All data and assumptions behind the game were based on published, reputable and Cornwall-specific sources such as Cornwall Council's energy technical reports, DECC energy statistics and Energy Saving Trust studies.

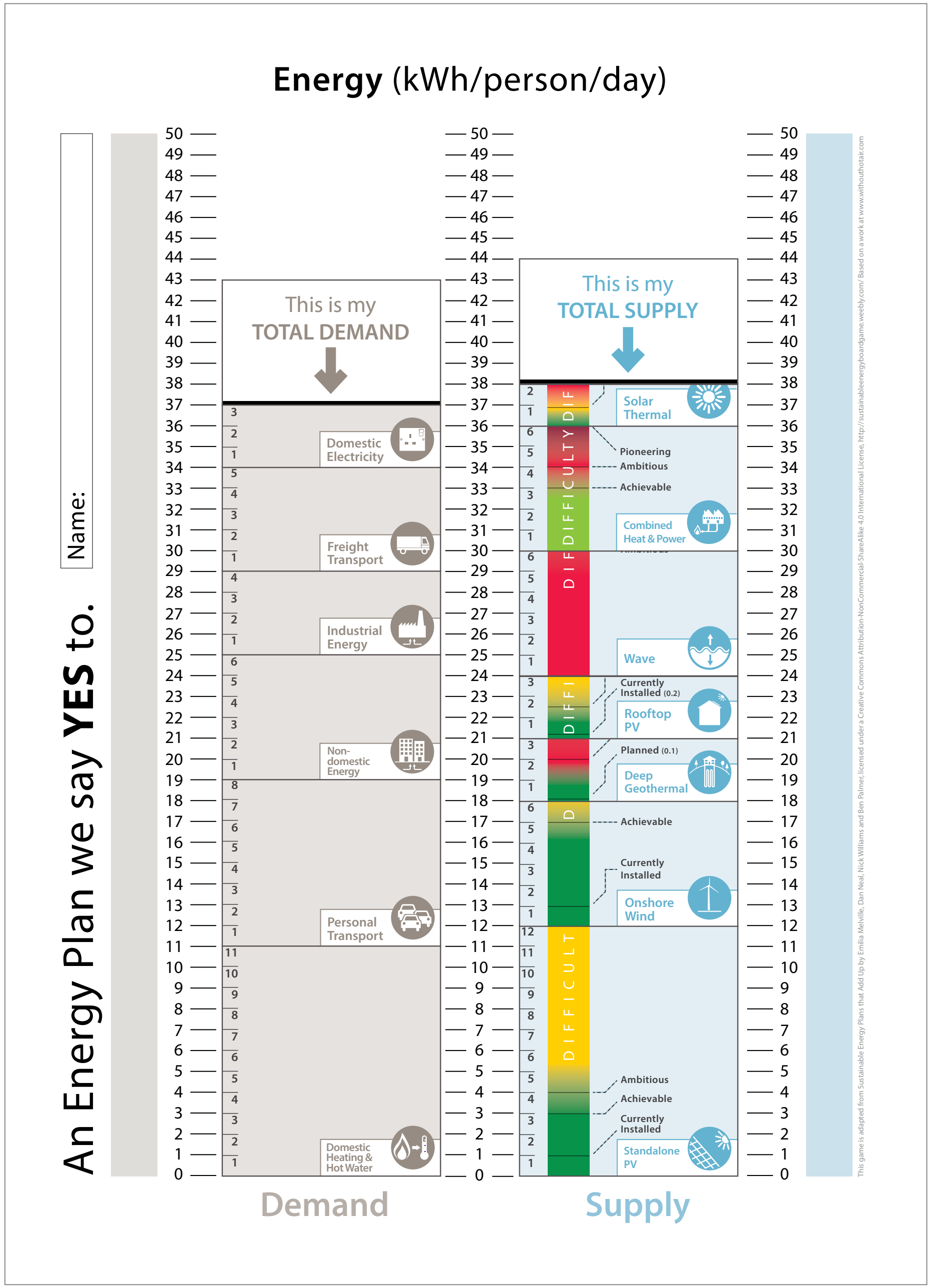
Simplifications were kept to a minimum, however an easy to understand game was the primary objective. Therefore two key simplifications were necessary:

- All energy forms are equivalent (electricity, heat, transport fuel)
- Only the annual balancing of supply and demand is considered.

The participants were given information on current energy consumption in six demand categories, and the potential impact of measures that could be taken to reduce this.

The participants were also given information about the maximum renewable energy potential from each technology. This maximum potential was assessed through consideration of factors such as the following:

- **Technical:** To consider where gets the most wind, most sun etc.
- **Environmental:** Limitations to location of renewable energy generation e.g. not next to train lines. Sites of Special Scientific Interest, (SSSI), Areas of Outstanding Natural Beauty (AONB), etc.
- **Landscape:** Assessment on landscape impact – which largely affects the density of systems in an area to prevent changing of the 'character' – is a project by project assessment, but generalised within these assessments.



Overview of a completed game board

This image shows an example of a completed gameboard. The cards representing demand categories and supply technologies are stacked on top of each other to show the selected level of demand and supply for each card.

In this example, supply and demand have been balanced, with a small margin of extra supply. This is a comfortably successful outcome, but does not achieve substantial export of energy.

In the workshop in Cornwall, many scenarios were created where supply was substantially greater than demand, leading to a potential for economic benefit through export of energy.

Throughout the Power Games, the unit of kWh/person/day is used. This is a unit of energy chosen to make energy consumption tangible on a personal and daily scale. The unit of kWh is familiar to people who read their energy bills.

The following pages give detail on the selection made by participants for each of the demand categories, and for each of the supply technologies. Each group developed a different scenario, based on their selections for demand and supply. After reporting on the results for demand and supply, the implications of implementing the scenarios developed in Cornwall are explored, with a discussion of the average, minimum and maximum impact on land and sea take, grid capacity, capital cost, 'islandness', and on jobs and local economy.

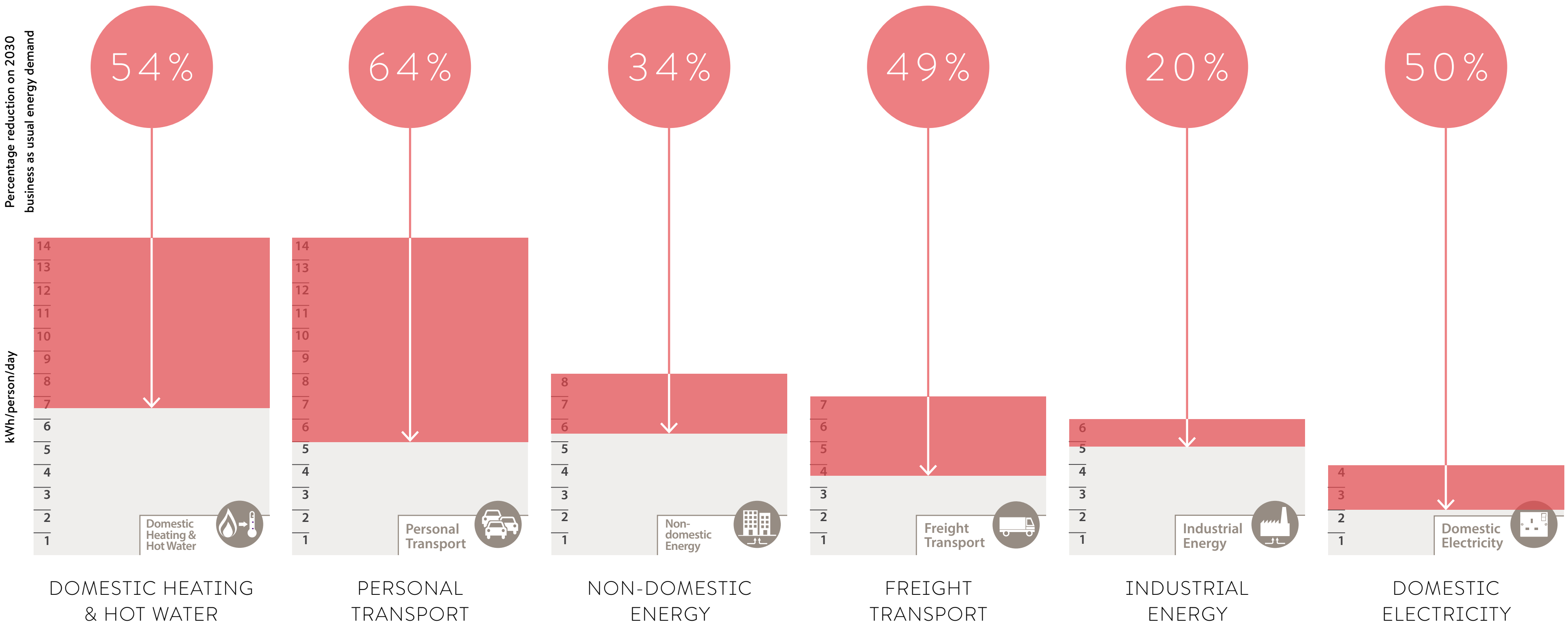
POWER GAMES: DEMAND

Demand-side reductions were considered by all stakeholders, initially individually and then as groups. These included considering reductions under six key headings of domestic heating and hot water, personal transport, non-domestic energy, freight transport, industrial energy, and domestic electricity. These are each discussed in turn, starting with the demand category with the largest per capita 'business as usual' energy demand in Cornwall in 2030, (domestic heating and hot water), and gradually moving through each category to the lowest per capita energy demand (domestic electricity).

In the Power Games session, groups agreed to reduce demand by an average of 49%

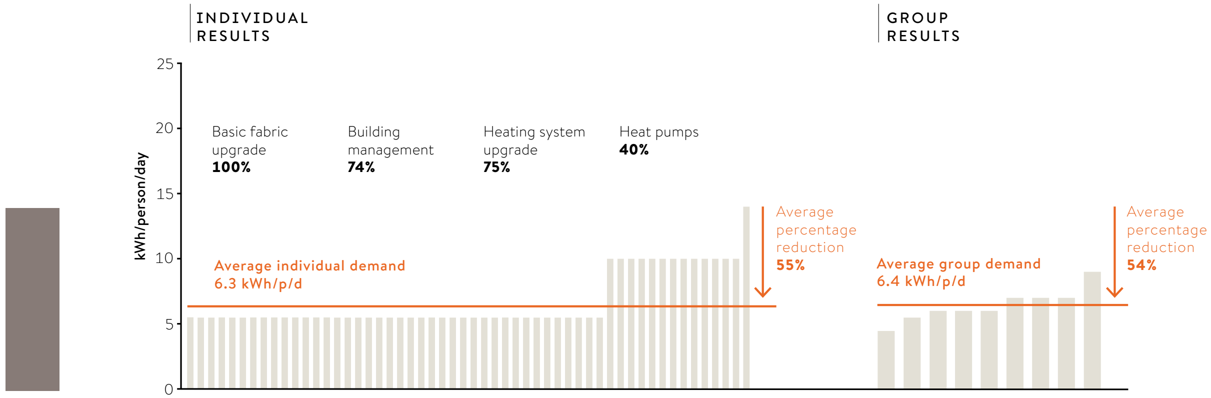
DEMAND

AVERAGE GROUP REDUCTION CHOICES FOR EACH DEMAND CATEGORY



DEMAND CHOICES RESULTS

The following pages summarise the individual and group choices for each demand category. This is shown in the format of a graph similar to the one below.
Scroll over the numbered sections to see an explanation of each results table component.



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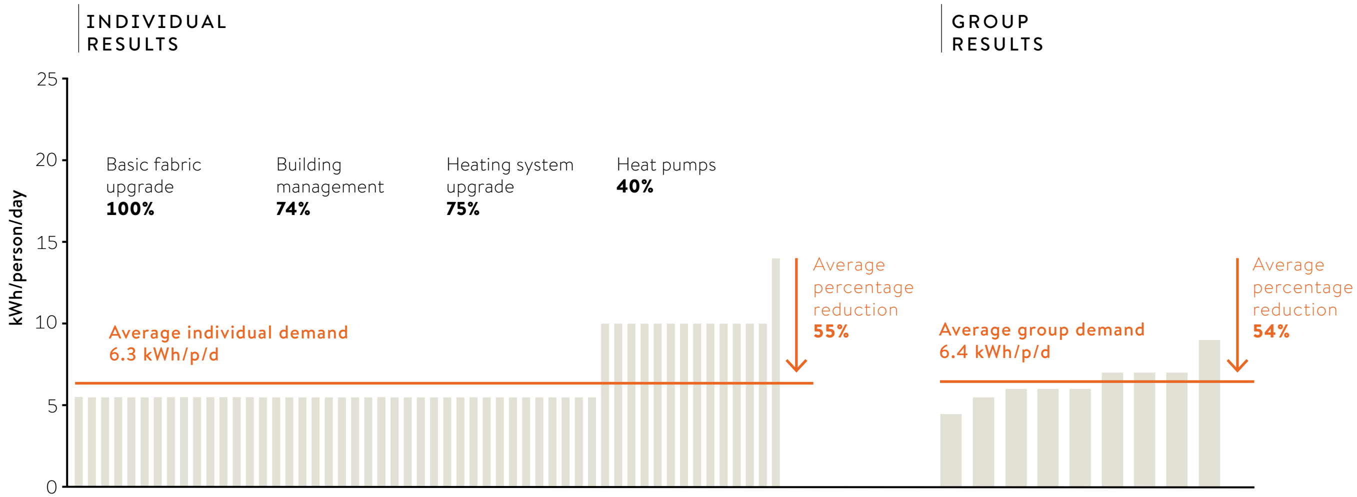
The grey bar represents the business as usual per capita energy consumption in 2030 without any demand reduction measures.

DOMESTIC HEATING AND HOT WATER

Domestic heating and hot water account for a quarter of all energy consumption in Cornwall. This is high demand is partly due to the old housing stock and only fifty percent of houses being connected to the gas network. Domestic refurbishment provides opportunities to significantly reduce this demand and should be a key focus area in regional and national policy.



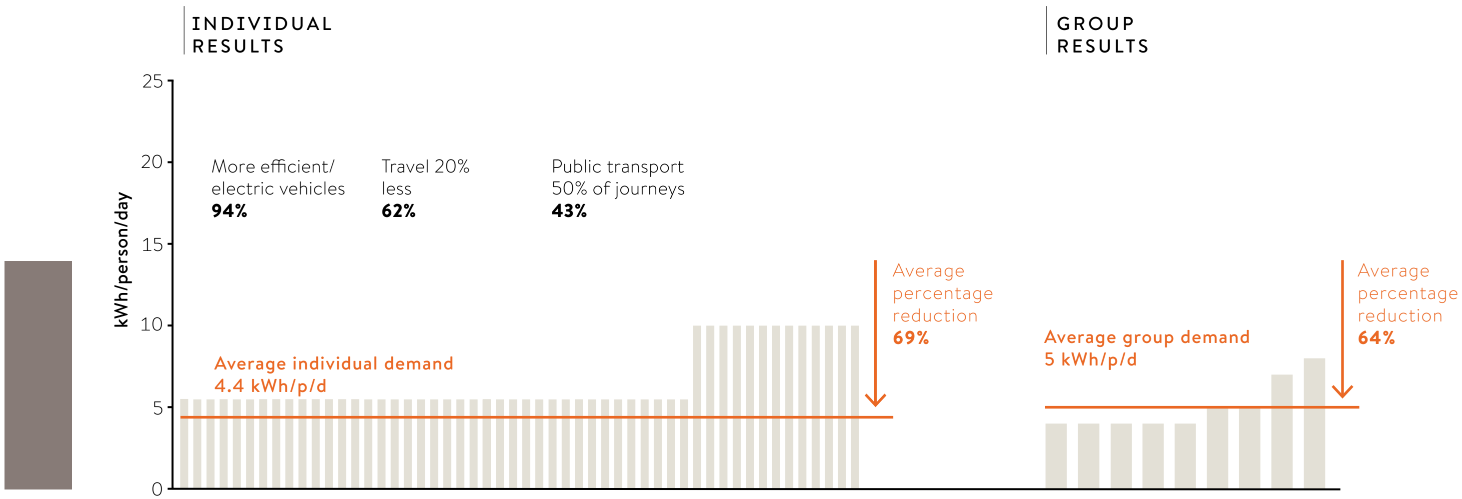
Building fabric upgrades focus on improving the insulation and airtightness of properties to reduce space heating demands through measures such as loft insulation, wall insulation, draught-proofing and installation of double glazing. In some properties, the feasibility of certain measures is restricted by construction type (e.g. solid-wall) and heritage constraints (e.g. listed buildings). However, 75% of workshop participants chose to implement all measures (comprehensive fabric upgrade), whilst all selected to implement at least a basic fabric upgrade (some measures).

Building management savings are associated with active management of demand within homes, such as effective use of heating controls/ timers, and turning down the heating set-point.

Traditional heating systems can be upgraded to high efficiency boilers, or replaced by more efficient systems such as heat pumps. The cost and technical challenges of installing heat pumps in the UK is reflected by the relatively low uptake of heat pumps in the game.

PERSONAL TRANSPORT

Energy consumption associated with personal transport in Cornwall is higher than the UK average. This is due to the rural character of the region, which creates longer travel distances and poorer coverage of public transport routes. This demand is estimated based on DECC traffic models and represents all energy consumed within Cornwall, rather than fuel sales.

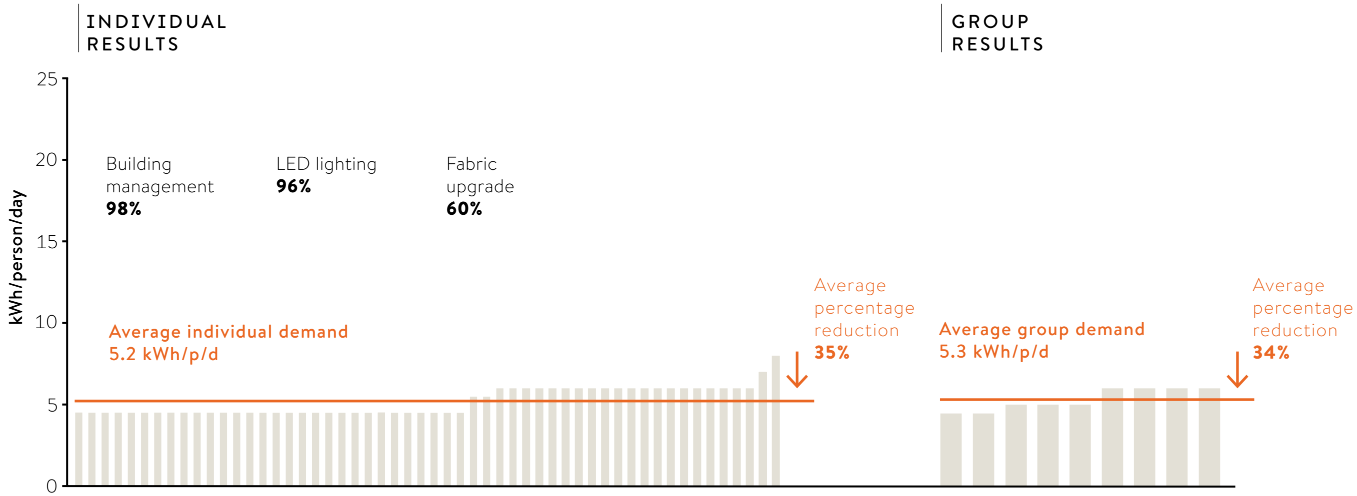


Personal transport, particularly in Cornwall, is dominated by private vehicle usage. As a result, investing in more efficient fossil fuel based vehicles or electric vehicles can deliver significant energy demand reductions. New EU emissions standards have significantly improved the efficiency of new petrol and diesel cars, however electric vehicles offer significant further efficiency improvements due to the use of an electric motor compared to a combustion engine. Electric vehicle uptake within the UK is currently quite limited. Buying a new electric vehicle may be beyond the budget of most Cornish household, but two thirds of workshop participants thought they would consider buying one due to their high energy savings.

In addition to technological options, behaviour change is a key opportunity area for reducing the energy demand associated with personal transport. Efforts to utilise more public transport provide savings through the reduced energy consumption per passenger km, and active decisions to travel less by reducing the need for travel (e.g. working from home, shopping locally) and also walking and cycling is an opportunity to further reduce energy-consuming journeys.

NON-DOMESTIC ENERGY

Non-domestic energy includes all heating and electricity demands associated with non-residential properties in the region, such as offices, hospitals, hotels, etc. Consequently, introducing energy saving measures into these properties is less an individual decision, driven more by businesses and organisations within the region.



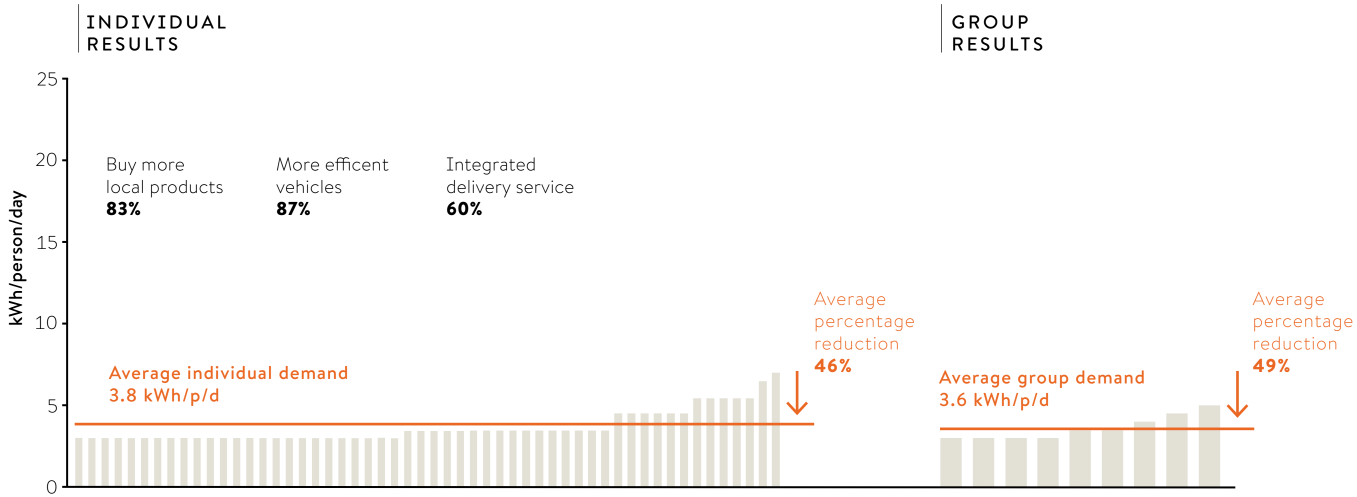
When considering the potential for non-domestic demand reductions, participants' workplaces was the most obvious reference. Major interventions are less feasible within this setting than in homes, as business and services must be unaffected but participants felt there were some quick wins available. Installation of high-efficiency LED lighting for example is fast becoming business-as-usual in new buildings and refurbishments, the results indicated there was significant potential for this within the region. The impact of lighting energy efficiency is variable between buildings, however within commercial office space and retail it accounts for a significant proportion of demand and can therefore deliver significant savings.

In addition to technology savings, it was generally agreed that buildings could be better managed to reduce demand including ensuring lights are turned off, systems are effectively controlled etc.

The impact of fabric upgrades on non-domestic buildings, is highly sensitive to the building typology, and this was reflective in participants' answers. In buildings such as offices, fabric upgrades are likely to have a limited impact but heat-led buildings such as hotels may be more effective.

FREIGHT TRANSPORT

Freight transport energy demand, much like public transport, is above average compared to the UK due to the rural character of the region defined by low population density and dispersed settlement pattern.

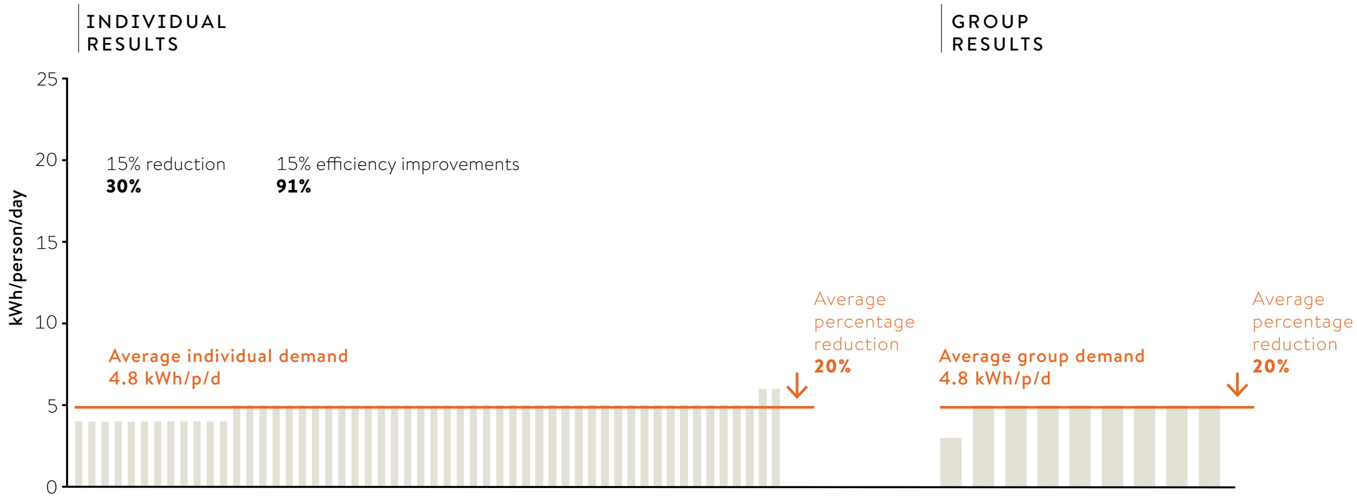


Similarly to personal transport, it was generally appreciated that efficiency improvements would be achievable within the vehicle fleet due to improved aerodynamic design and engine efficiency, in the order of 25%. Opportunity for Electric Vehicles was not considered as it was felt that range would continue to be a limiting factor for long-distance journeys.

Increased shift to consumption of local resources can deliver sustainability benefits beyond reducing energy demand. This approach was widely agreed upon, with the majority of participants choosing it as a viable demand reduction measure. Having reduced demand, it was also considered that any demand which remained could be provided more efficiently through aggregation of different delivery services to reduce unnecessary travel distances associated with products. This has been trialled with some success in European cities with limited road infrastructure in an attempt to minimise traffic disruption.

INDUSTRIAL ENERGY

Industrial energy demand encompasses manufacturing, mining and agricultural activities within Cornwall. While the mining industry in Cornwall is significantly less active than it was 30 years ago, it remains a key parts of Cornwall's landscape and large existing facilities such as the Imerys china clay pits are still operational.

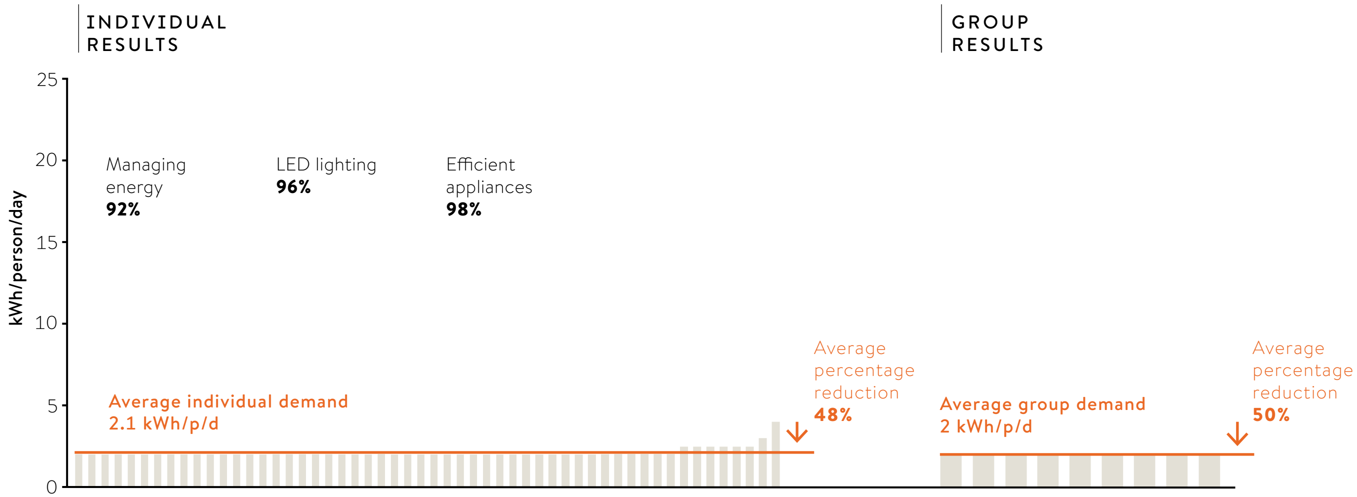


Efficiency is typically a high priority in these industries as it is one of the dominant operating expenditures, so opportunities for further significant savings are likely to be limited. However, it was suggested that savings of 15% may be achievable, with over 90% of participants in agreement.

Reduction in mining industrial activity within the region also brings a reduced energy demand, as processes such as clay-drying are often highly energy-intensive. However, the economic value of industry means that participants did not consider the actively reduction of industrial activity to be a positive step, despite the potential energy impacts.

DOMESTIC ELECTRICITY

Electricity consumed within households, whilst often promoted as a key target for energy efficiency improvements, represents less than 10% of energy demand within Cornwall. Efficiency measures are available, however the relative impact is small due to the low absolute demand.



In general, electricity demand reduction measures were considered highly viable in domestic properties as they were cost-effective methods of reducing household bills. With high levels of fuel poverty in Cornwall this is a key driver for change.

More effective management of electricity demand, such as ensuring lights are off etc. was considered a viable measure within domestic properties. While there is widespread awareness of energy saving behaviour such as turning off lights and not using standby modes, further improvement was still considered achievable.

LED lighting was considered a business as usual intervention within non-domestic buildings. The domestic LED market is significantly less developed compared to commercial buildings, mainly due to customer awareness, however it was considered across the board that this would be a viable measure as people would soon realise and learn of the financial benefits available. Efficiency improvements in household appliances were also expected in the coming decade and with frequent replacement cycles of household technology, over 95% of participants agreed this would provide savings.

POWER GAMES: SUPPLY

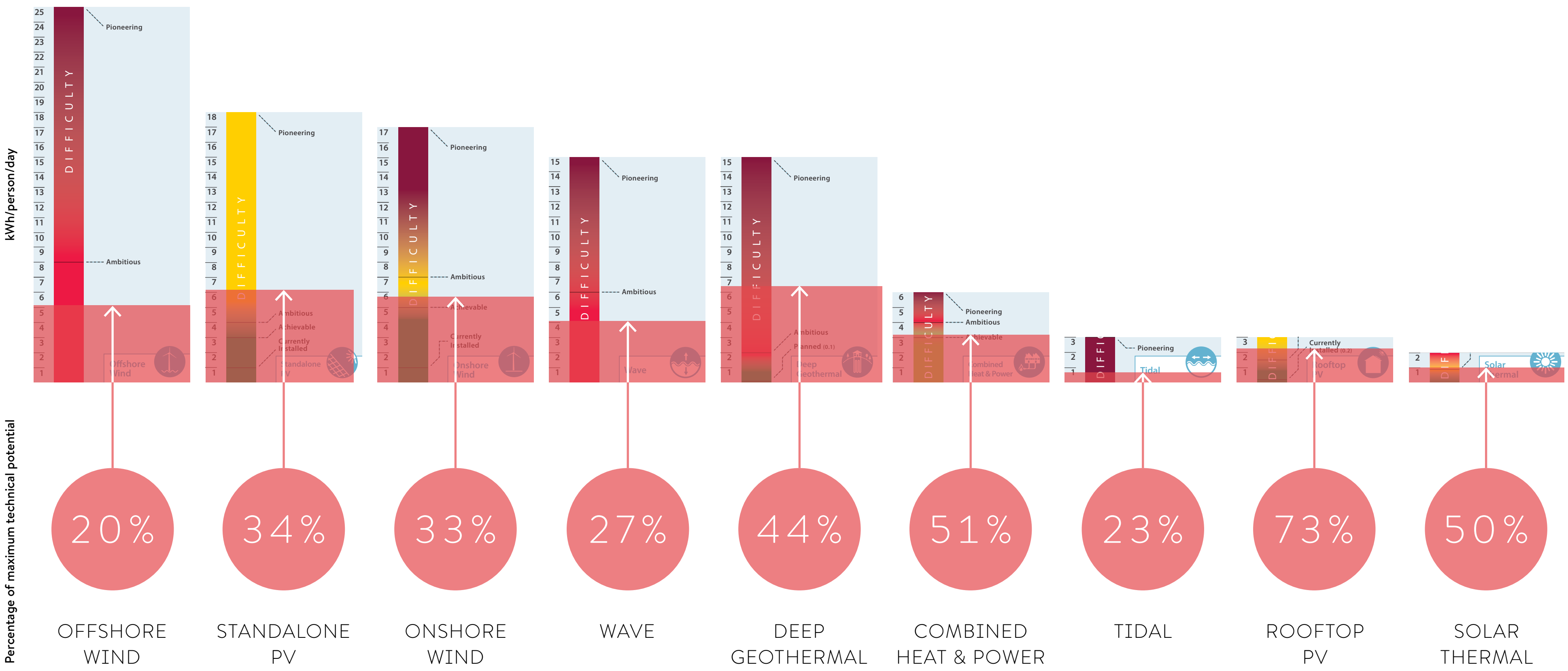
Supply side generation options were considered by all stakeholders, initially individually and then as groups. These included considering nine different generation technologies including offshore wind, standalone PV, onshore wind, wave, deep geothermal, combined heat and power, tidal, rooftop PV and solar thermal. To inform the choices, participants were given information on the risks, land/sea areas required, and costs. These are discussed in this section, starting with the technology with the largest technical potential, offshore wind.

All groups generated a surplus of energy, after energy demand reduction

The surplus varied from 4% to 60%, with an average surplus across the groups of approximately 30%, providing an opportunity for money to flow into Cornwall.

SUPPLY

AVERAGE GROUP CHOICES INCREASE ENERGY SUPPLY



SUPPLY CHOICES RESULTS

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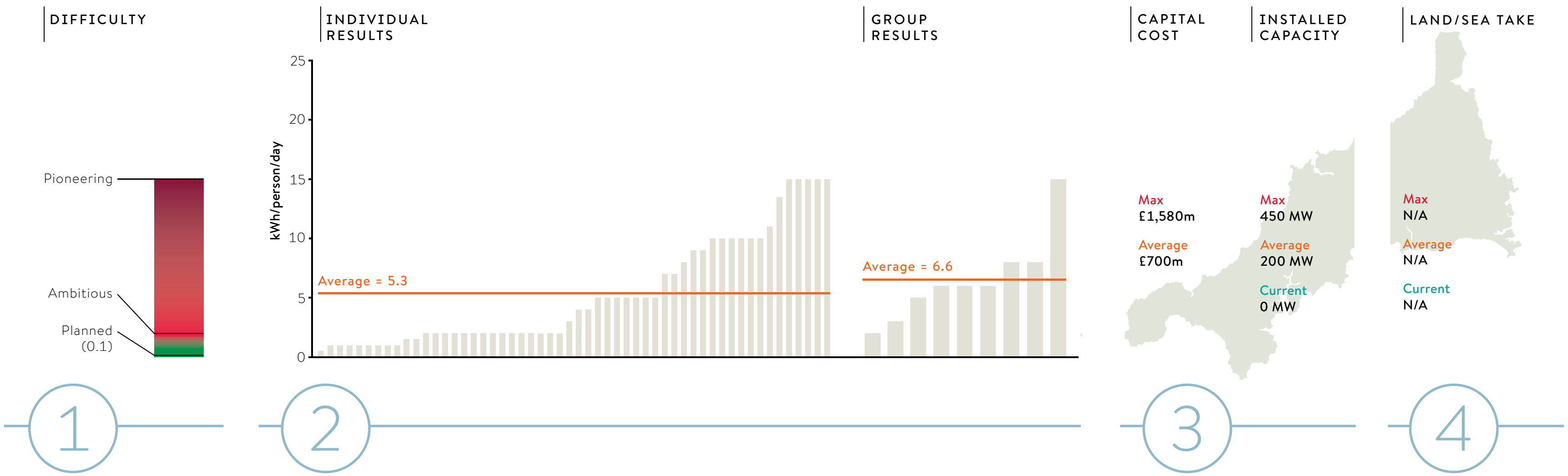

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The coloured bar represents the difficulty associated with deploying the specific renewable energy technology at this scale.

This is a subjective rating based on technology uptake to date and our understanding around the future potential of the technology within the context of Cornwall.

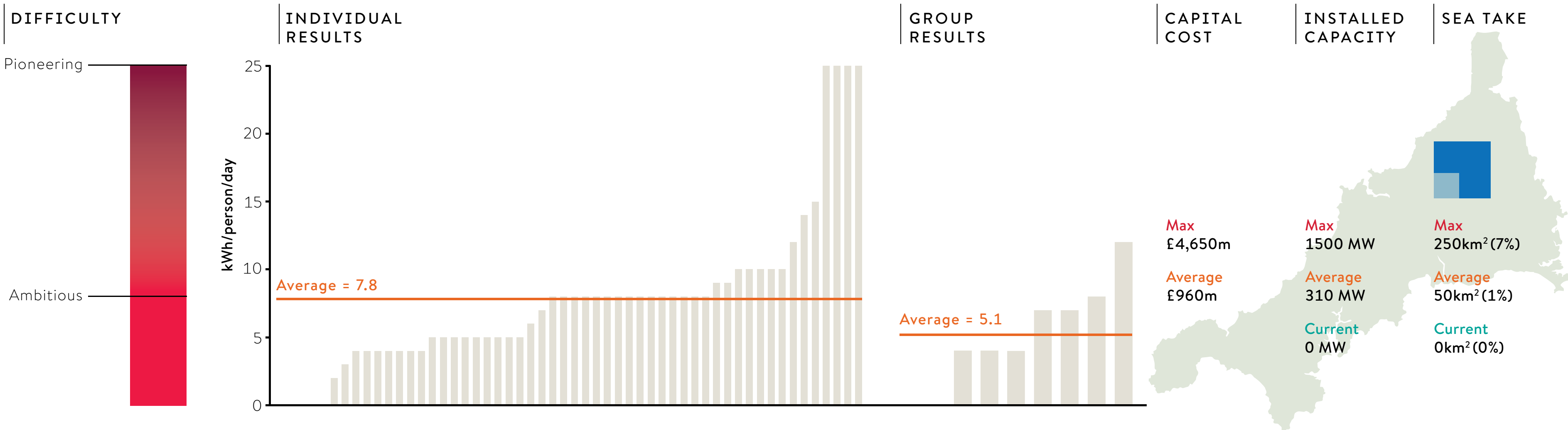
Example factors affecting this rating are shown in the image on the right.

- High risk of objection (e.g. visual impact)
- Commercially unproven technologies

- Aligned with current deployment trends
- Commercially proven technologies
- Low risk of objection (e.g. low aesthetic impacts)

OFFSHORE WIND

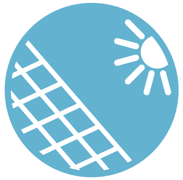
Currently there are no offshore wind installations within Cornwall, although offshore wind has the potential to make a substantial contribution to the UK energy generation portfolio. Due to the large sea depths off the Cornish coast, turbines cannot be mounted on the sea bed and therefore require floating structures to support them. This technology has yet to be proven on a commercial-scale, however it is currently being researched extensively.



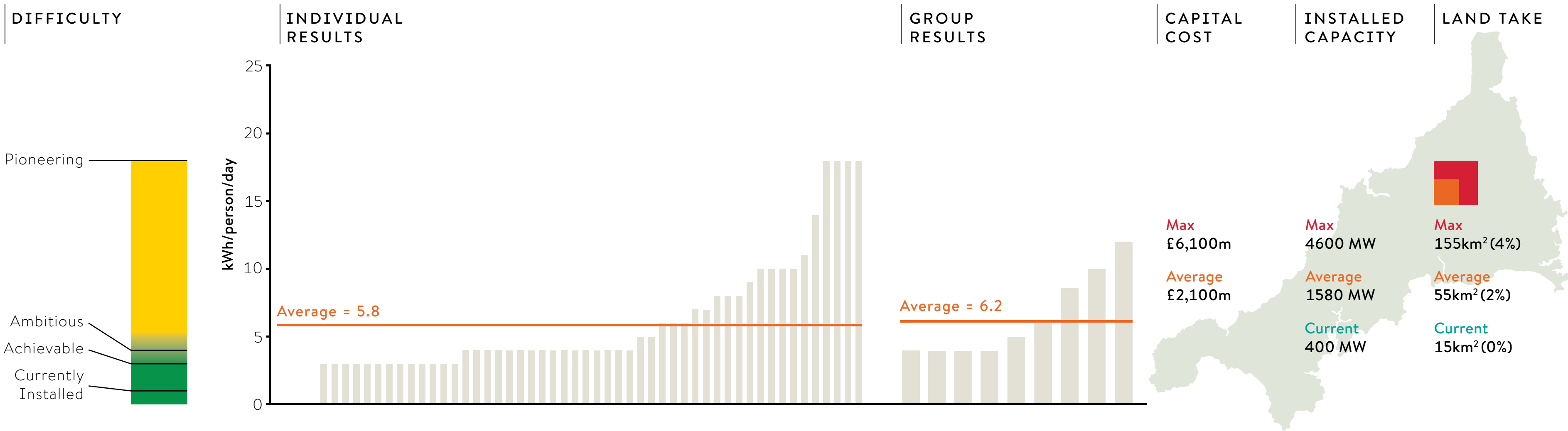
Offshore wind potential is widely cited as the best renewable energy resource available in the UK. However, with the necessity of commercially unproven floating structures for Cornish offshore wind it is considered high risk and high opportunity for the region. The difficulty levels for offshore wind were based on projected deployment rates from a SWRDA offshore potential study; Ambitious represents the total capacity projected for 2025; Pioneering the projected capacity for 2030. The difference in these values represents the expected innovation and commercial maturity of the technology between those dates.

Opinion was split amongst participants, with many taking a cautious approach to the risk of such technology. Others reflected on the significant potential and were more confident that innovation would lead to deep offshore wind becoming viable. Onshore wind is an issue of much local dispute in Cornwall, therefore locating turbines out at sea was considered of significant benefit for reducing landscape impacts. However concerns regarding the views from the coastline, and the impact on coastal ports from the onshore construction of the turbines prior to deployment were also discussed.

STANDALONE PV



Standalone PV (e.g. solar farms) is currently the largest generator of renewable energy in Cornwall. With the highest solar radiation of all regions in the UK, it offers the greatest potential yield and with an abundance of rural land the installed capacity has significantly developed over recent years.



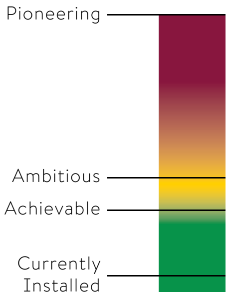
The rapid development of solar farms across the Cornish landscape has created tension regarding their visual appearance. It has also caused stress to the local power infrastructure, with very high seasonal power generation pushing grid capacity to its limit.

Levels of potential were classified by land available within technical (e.g. distance to the grid) and environmental (e.g. not within AONB) constraints, and subject to LCA (landscape character assessment) which assesses detrimental impact on the landscape value (primarily defined by proximity and scale of installations). The landscape constraints were included for difficulty levels up to 'Ambitious', but removed for the Pioneering level, making significant further technical potential available. Some greater output could be possible from innovation in panel efficiency and farm configurations. In general participants were reluctant to select a potential above the Ambitious level, emphasising the importance placed on protecting the landscape value in Cornwall.

ONSHORE WIND

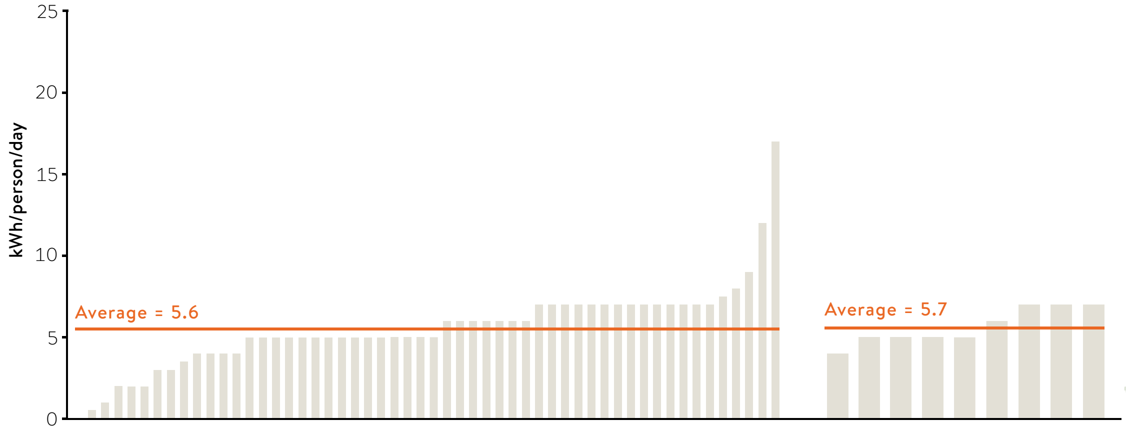
Onshore wind is currently the second largest generator of renewable energy within Cornwall. The region receives strong prevailing winds from across the Atlantic, providing high potential for energy generation with a very mature and cost-effective technology. Much like Standalone PV, the other dominant generator in the region, new developments are often met with strong public opposition denouncing its visual impact on the landscape.

DIFFICULTY



INDIVIDUAL RESULTS

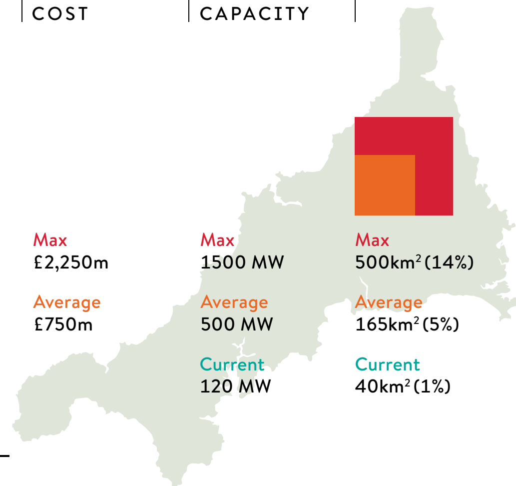
GROUP RESULTS



CAPITAL COST

INSTALLED CAPACITY

LAND TAKE



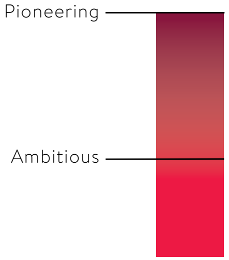
The Achievable level of potential was defined as all areas within technical and environmental constraints, and subject to LCA. This landscape assessment was removed for the Ambitious level, and Pioneering represented a value closer to absolute technical potential assuming some of the environmental and technical constraints were overcome. This is clearly of greater difficulty, however environmental constraints such as proximity to grid connections could be feasibly overcome with moderate infrastructure investment.

In general there was limited appetite for further onshore wind amongst participants, with many stating that they felt the region was already saturated with wind farms causing an imposing presence on the Cornish landscape.

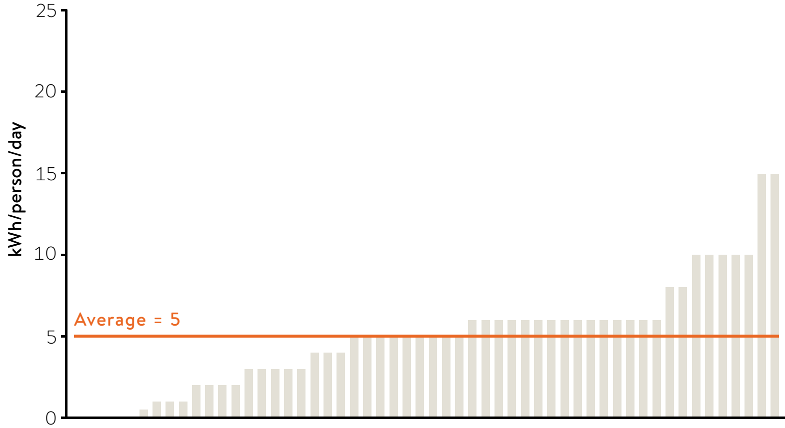
WAVE

Wave power technology has yet to be commercially proven in any context, but has and remains to be subject to comprehensive research and development efforts. As an Island with a long Atlantic coastline, the United Kingdom is a prime location for marine technologies and as a result is home to many research facilities, including the WaveHub and FaB Test which are located in Cornwall.

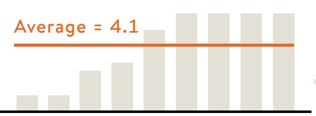
DIFFICULTY

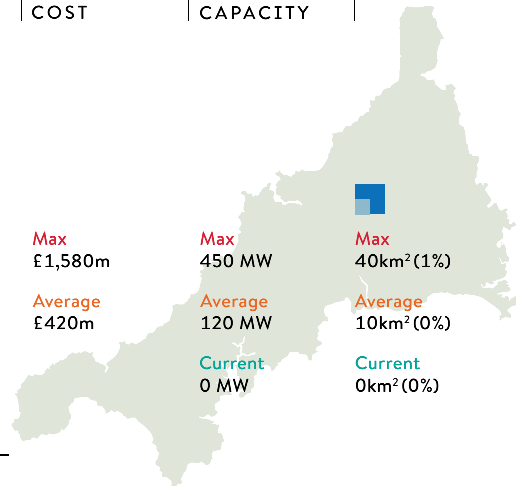


INDIVIDUAL RESULTS



GROUP RESULTS



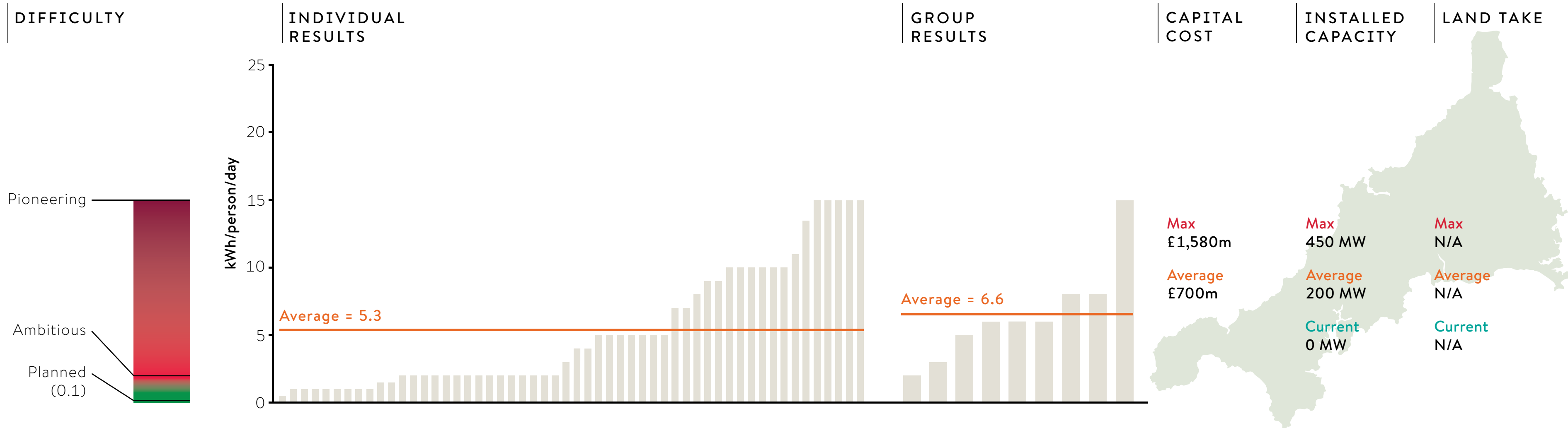


CAPITAL COST	INSTALLED CAPACITY	SEA TAKE
Max £1,580m	Max 450 MW	Max 40km^2 (1%)
Average £420m	Average 120 MW	Average 10km^2 (0%)
	Current 0 MW	Current 0km^2 (0%)

Studies into the potential for Wave power have indicated a large resource around the coastline of Cornwall, dependent on technological advancements which are expected circa 2025/2030. Installed capacity projected for 2025 was used for the Ambitious level, with further advancements by 2030 used for Pioneering. Regardless of the estimated resource potential, due to the lack of commercially available systems it was considered a high risk/difficult technology for all levels.

DEEP GEOTHERMAL

Within the UK, Cornwall has the greatest potential for deep geothermal energy. While not yet commercially proven within the UK, it is widely used in other countries, and two plants have been granted planning permission in Cornwall.

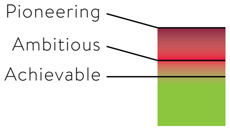


Potential for the technology has been assumed as being electricity generation only. Establishing plants which are also able to sell waste heat to a district heating network often presents greater commercial viability, but this requires the close proximity of an adequate heat demand. Technical potential was based on a study highlighting the technical potential within the region. Due to the risk associated with deep geothermal energy (currently unproven, very high capital costs for well drilling) this was treated as Pioneering with a conservative proportion of that potential, 10%, considered as Ambitious. Whilst considered a difficult and high risk opportunity, the unique local strength of Cornwall in deep geothermal potential is reflected with a general positive view of the technology, due to the possible knock-on economic and employment benefits it would deliver to the region. This is also a technology with low land take and high energy generation potential, key factors contributing to it being seen as a favourable choice, given the contentious nature of visual impact on the landscape.

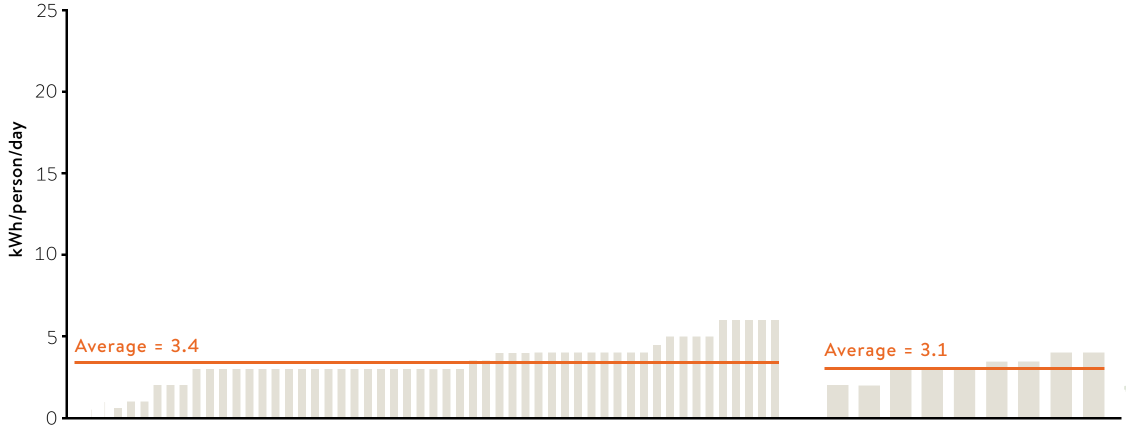
COMBINED HEAT AND POWER

Combined Heat and Power (CHP) is a widely used technology for providing low-carbon heat and electricity on a wide-range of scales from individual buildings to town-scale district heating systems. For Cornwall, the renewable energy potential was classified by the amount of fuel resource available from biomass (agricultural waste and energy crops) and refuse incineration (Energy from Waste).

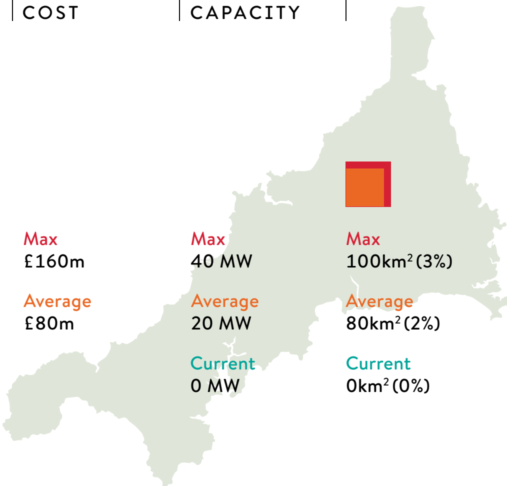
DIFFICULTY



INDIVIDUAL RESULTS | **GROUP RESULTS**



CAPITAL COST | **INSTALLED CAPACITY** | **LAND TAKE**

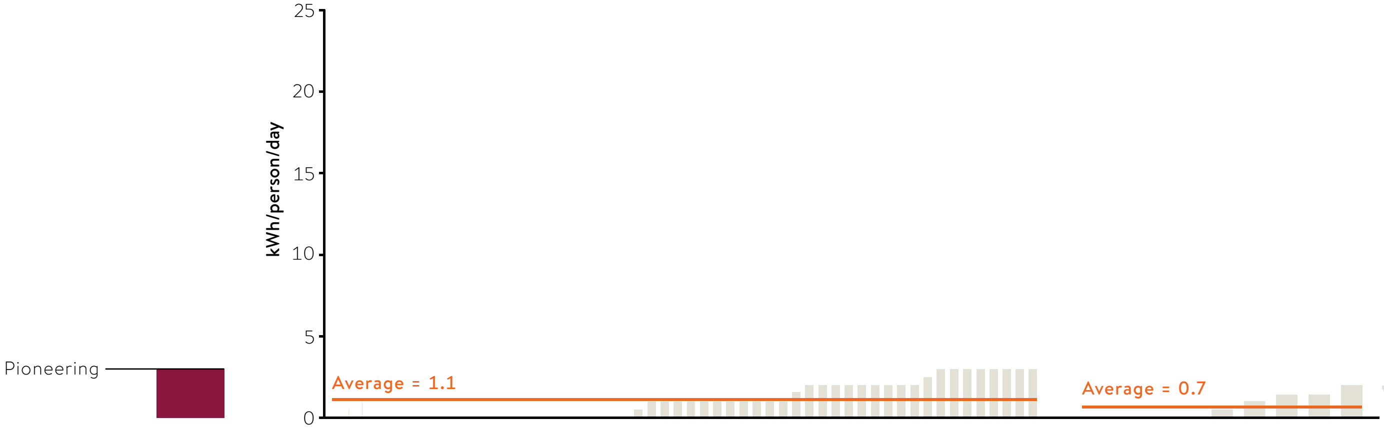


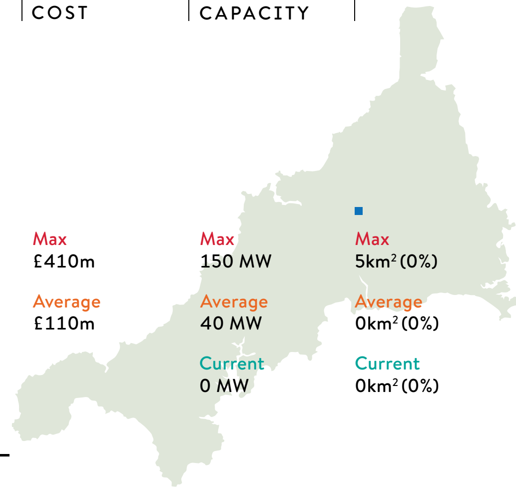
A key viability factor for the use of Combined Heat and Power is an adequate heat demand density. With regard to this potential, it is assumed that suitable heat demand density is achievable through urban heat network development and that the fuel resource is the limiting factor. The Achievable level includes all waste fuels and utilising 5% or arable land for growing energy crops such as Miscanthus, with the Ambitious level increasing energy crops to 20% of arable land, and Pioneering including some CHP from geothermal plants (which are otherwise assumed to generate electricity only). Utilising waste heat resources limits the land impacts of this technology, however a larger reliance on energy crops requires agricultural land which would otherwise be used for food production.

TIDAL

Tidal stream turbines function similarly to wind turbines, harnessing underwater currents rather than air currents. By analogy, this is therefore a very mature technology, however there are specific challenges with the underwater marine environment, and there are currently no large scale commercial tidal stream systems in operation, with a handful under development.

DIFFICULTY | INDIVIDUAL RESULTS | GROUP RESULTS | CAPITAL COST | INSTALLED CAPACITY | SEA TAKE



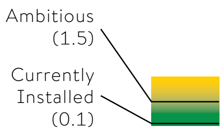


The Cornish coastline has been identified as an area of potential for tidal stream energy, however due to the lack of existing installations it is considered high difficulty/risk. Due to these challenges, the identified opportunity, West of Penzance, was classified as Pioneering as it could be one of the first installations of this size in the world. Tidal stream technology was favoured by participants due to the low visual impact and local opportunity, however there was also caution due to the risks and challenges of delivery of innovative technology.

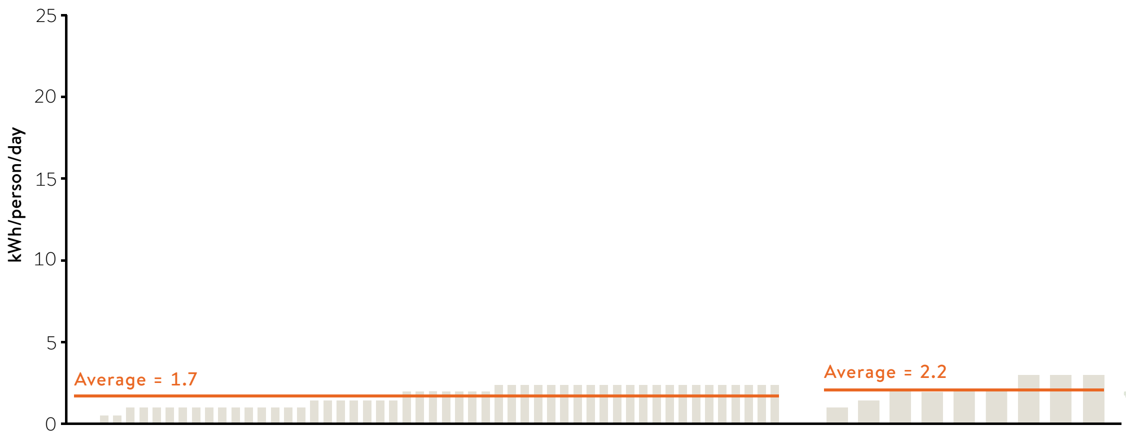
ROOFTOP PV

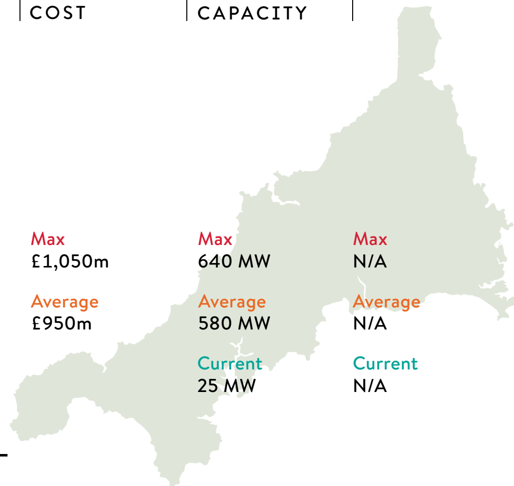
Rooftop PV refers to the installation of solar panels on building roofs, as opposed to large ground-mounted solar farms. Due to the high levels of solar irradiation in Cornwall, installation of Solar PV, particularly on domestic properties, has grown more rapidly than in other parts of the country. This has been supported by Feed-in-Tariffs and the rapid drop in the cost of PV panels.

DIFFICULTY



INDIVIDUAL RESULTS / **GROUP RESULTS**





CAPITAL COST	INSTALLED CAPACITY	LAND TAKE
Max £1,050m	Max 640 MW	Max N/A
Average £950m	Average 580 MW	Average N/A
	Current 25 MW	Current N/A

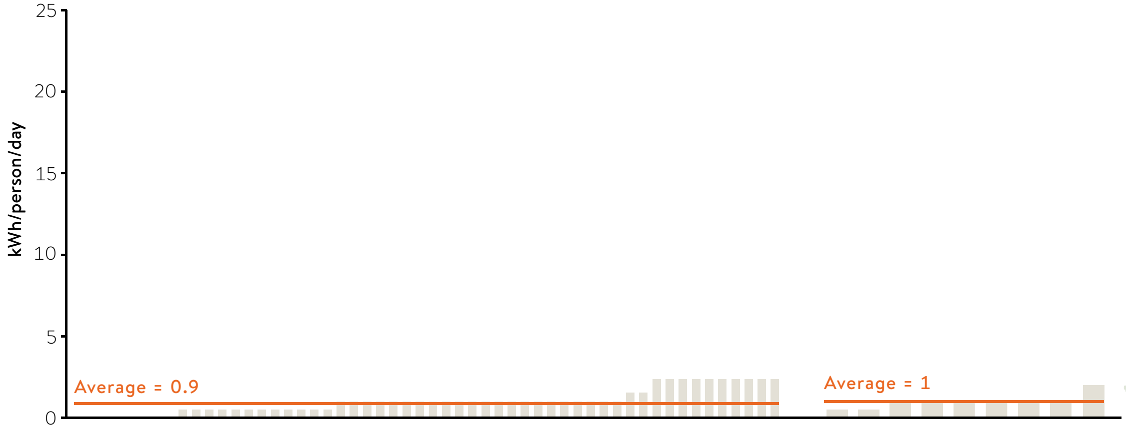
The potential for rooftop solar PV is limited by the amount of suitable roof space (orientation, size, heritage restrictions) and panel efficiency which is an area of constant innovation and development. Achievable level of potential was set as an average array (2.5kW for domestic, and 5kW for non-domestic) for 25% of domestic and 50% of non-domestic properties. These array sizes per building were increased by 60% (through better panel efficiency and/or a greater panel area) for the Ambitious level, and the number of buildings with installations was increased to assume 50% of all domestic properties for Pioneering. Achieving solar PV installations across 50% of all roofs in Cornwall is an extremely challenging target, but with supportive legislation and incentive schemes it is considered possible.

SOLAR THERMAL

Solar thermal collectors harness energy from the sun to produce renewable heat for domestic hot water systems. They are extensively used across Europe, and have been used for many years within domestic properties in the UK. Use within the commercial sector has not been considered as hot water demands are typically low and therefore it does not represent an attractive investment.

DIFFICULTY

INDIVIDUAL RESULTS | **GROUP RESULTS**



CAPITAL COST

Max
£750m

Average
£380m

INSTALLED CAPACITY

Max
0 MW

Average
0 MW

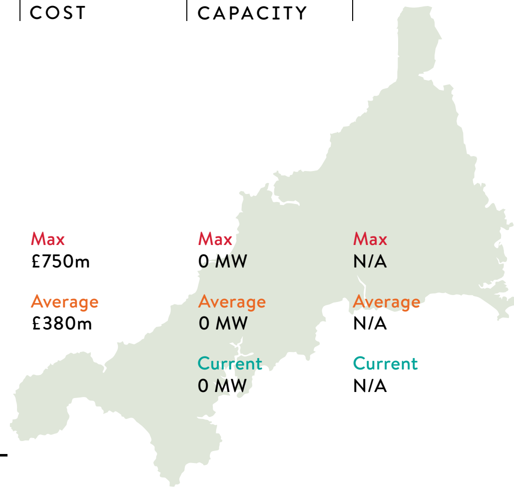
Current
0 MW

LAND TAKE

Max
N/A

Average
N/A

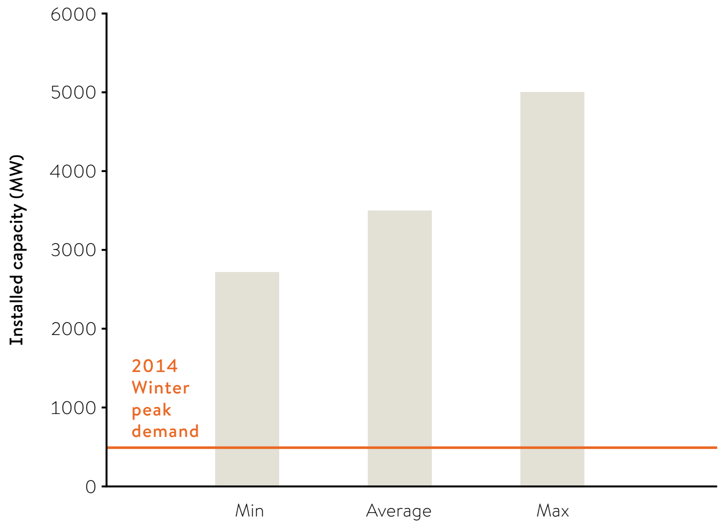
Current
N/A

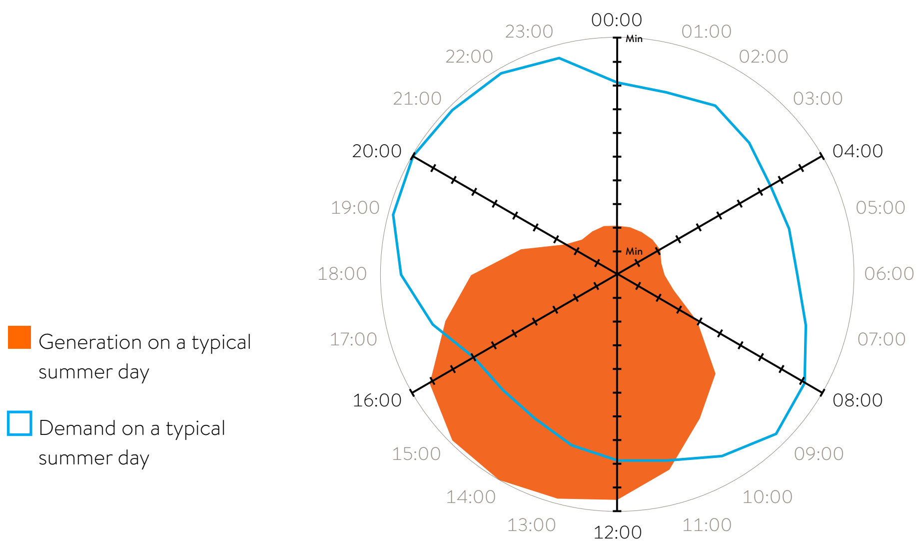


Despite the well-established market for solar thermal, the renewable energy potential is low due to the limitation of available domestic property roofs space. Another limiting factor is the removal of hot water cylinders from many homes which have converted to combi-boilers for hot water. This challenge can be overcome by replacing the hot water cylinder, but this requires sufficient space to be available within the property, and can be expensive. Achievable potential was defined as 15% of domestic properties utilising an average sized system, Ambitious as 25%, and Pioneering as 50% of properties.

POWER GAMES: IMPLICATIONS FOR CORNWALL

GRID CAPACITY





Across the UK, constrained power distribution infrastructure is a major barrier to the large-scale deployment of renewable energy technology, with locally-specific effects. In March 2015, during the Cornwall Energy Island Event, Western Power Distribution announced that the electricity distribution grid in Cornwall was at capacity, and no new large-scale Solar projects would be granted connection agreements. This is primarily due to the high quantity of Solar PV generation that has been installed or has accepted connection agreement in Cornwall, and the divergence between demand and solar output in summer. *This limits the further development of the renewables sector in Cornwall.*

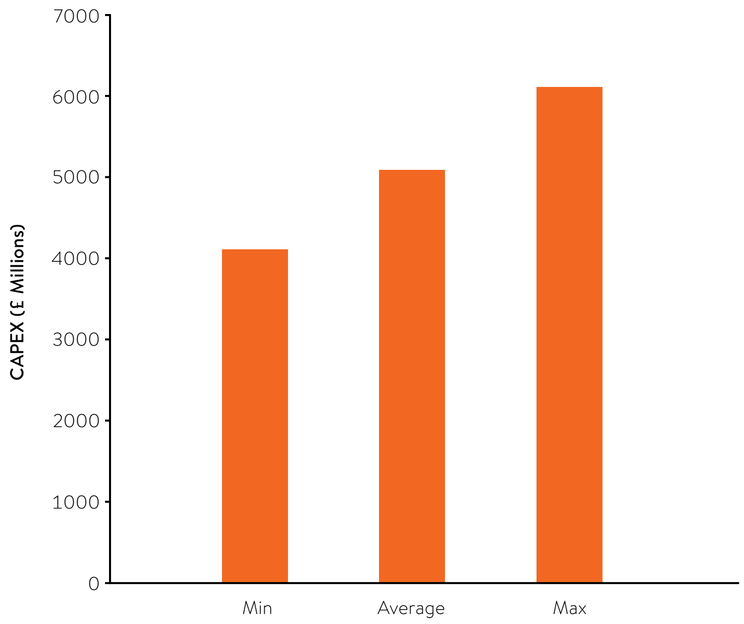
With grid infrastructure a key limiting factor today, it is vital to explore how the energy scenarios developed in the Power Games workshop would further exacerbate this issue. While it is unlikely that all of the installed renewable energy capacity will be operating at the same time, *the greater the difference between peak output and demand, the greater risk of excessive stress is placed on the grid*. As demonstrated above, even the minimum scenario represents an installed capacity over four times greater than the peak winter power demand.

Solutions could include:

- Better matching of demand with supply, such as the Sunshine Tariff currently being trialled in Wadebridge
- Investment in batteries for storage of electricity
- Use of other energy vectors such as hydrogen or heat to store energy
- Investment in grid reinforcement to reduce local bottlenecks and increase the capacity for export of electricity from Cornwall to the rest of the UK.

This is vital for the continued development of the renewable energy sector, and requires strategic investment in infrastructure. *A clear vision and leadership is needed* to enable this, due to the long procurement, consultation, funding and construction programmes often required for major infrastructure projects.

CAPITAL COSTS



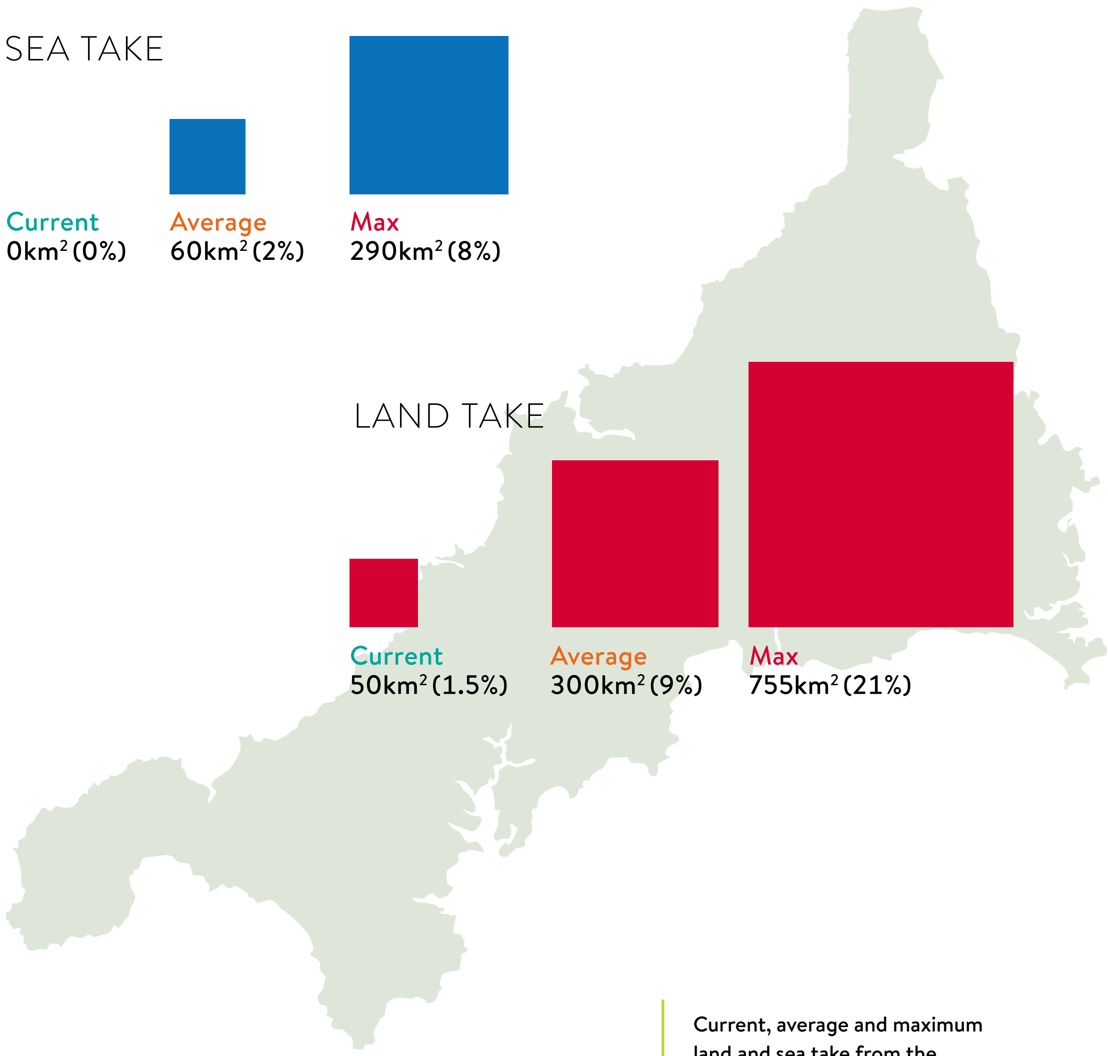
In the Power Games workshop, capital cost was not included as a metric as it was felt that comparing capital costs across renewable energy technologies of different scales and demand interventions was complex and potentially misleading. A cost-efficiency metric of £/kWh saved was used in the game, to highlight which measures delivered the best results for the least upfront investment.

The capital cost estimates for supply technologies only are presented, based on DECC Projected Costs studies[1], to highlight the magnitude of capital investment required to achieve the developed energy scenarios. As a comparative reference, the entire Dept. for Energy and Climate Change 2014-15 budget was £6 billion, which is just below the maximum capital investment of all the proposed scenarios.

It is important to note that these costs include no investment associated with demand reduction, and importantly no associated costs of infrastructure investment.

1 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66176/Renewables_Obligation_consultation_-_review_of_generation_costs_and_deployment_potential.pdf

IMPLICATIONS FOR CORNWALL LAND AND SEA TAKE



Current, average and maximum land and sea take from the Group scenarios.

Landscape impact, from a visual and land use perspective, is one of the most controversial issues for the development of renewable energy in Cornwall. The estimated land take of currently installed capacity is 50km², 1.5% of the area of Cornwall. It is important to understand how little area is actually taken up when discussing this sensitive issue, although this metric does not consider the impact of sight lines and the precise location of these installations.

In order to include this issue within our analysis, land and sea requirements associated with the chosen energy scenarios were estimated. While the overall objective of balancing supply and demand was achieved in all groups, the varying results in land take reflected the differing group opinions. Strong supporters of Solar PV and Onshore Wind chose scenarios which resulted in large landscape impacts, while groups aiming for an 'out of sight, out of mind' approach tended to prioritise offshore technologies with less of a visual impact.

'Sea take' is an interesting concept which raised much discussion during the session. While onshore landscape impact is often discussed, certain groups felt that the visual impact of offshore technology had not been given adequate consideration. Onshore AONB designations are a major tourist attraction for the region, but the coastline areas arguably offer even greater tourism value and it is views out to sea which would potentially be most affected by offshore technologies. Additionally, the impact on coastal areas and ports of the construction process and associated material deliveries is often overlooked.

‘ISLANDNESS’

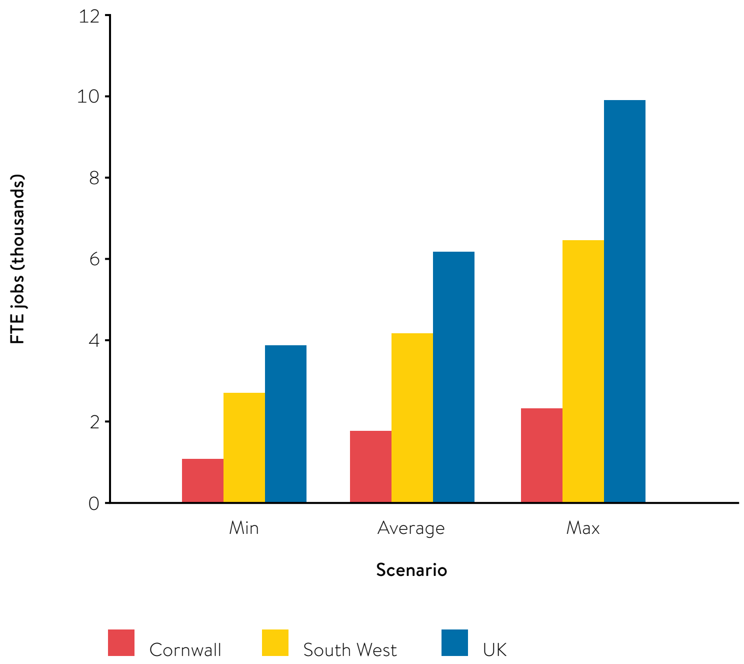
The metric of ‘Islandness’ concerns how Cornwall would interact with the UK energy system if it was set-up to generate 100% of its energy demands. This looks at how much energy is being exported or imported and at what time it occurs.

A low level of interaction between Cornwall and the UK indicates that the supply and demand profiles of the proposed energy system are well matched, i.e. a high level of ‘Islandness’. The majority of the renewable energy technologies considered in the scenarios are non-dispatchable, meaning it cannot be controlled when they generate. *For this reason a perfect supply/demand balance is not possible.* Reducing this interaction has technical benefits due to energy security, management of the grid and infrastructure reinforcement requirements.

Perhaps the more important metric regarding ‘Islandness’ is the cost/revenue impacts. Whenever there is a supply/demand imbalance, this results in an export and sale of electricity to the UK, or an import and purchase. The timings of these exchanges are important as they will affect the price of electricity whether it is being sold or purchased. Time-dependent tariffs are used to some extent within the electricity market at present, but rarely at a consumer level. With the roll-out of smart meters, this is likely to change and so the time at which energy is sold and purchased is likely to have a greater impact. By assessing at what time the various renewable energy technologies generate power (often based on weather conditions) and how this aligns with estimated demand, we were able to estimate whether it would be a profit-making or loss-making interaction with the UK energy system.

The performance of all scenarios varied greatly, driven by the selection of renewable energy technologies. For example although output from Solar PV varies significantly between winter and summer, *it only generates during daylight hours and is never generating at night when prices are lowest*. This is similar for Combined Heat and Power, as its operation is heating demand-led, which is aligned with when people are awake and using buildings and limited during the night. Wind energy however has a more constant generation profile on average over the year. This is beneficial from a technical point of view, as energy is constantly being generated, but at night when demand is low, the excess power is being exported when prices are very low and therefore revenues are poor.

JOBS AND LOCAL ECONOMY



Job creation and local economic benefit are an important part of the Cornwall Energy Island. There is a huge opportunity for jobs: in construction and installation of renewable energy technologies, in ongoing operation and maintenance, in deployment of energy efficiency measures, particularly home fabric upgrades. The extent to which these jobs are created in Cornwall, and the level of skill and quality of work that is available, depends on many factors: skills and training within Cornwall; the extent to which the supply chain is localised and manufacturing takes place within Cornwall, and more. The impact on the local economy is also affected by the extent to which spending is recirculated within it, and the extent to which capital investment is internal or external. A local energy market and local ownership and investment would retain more of the total energy spend within Cornwall.

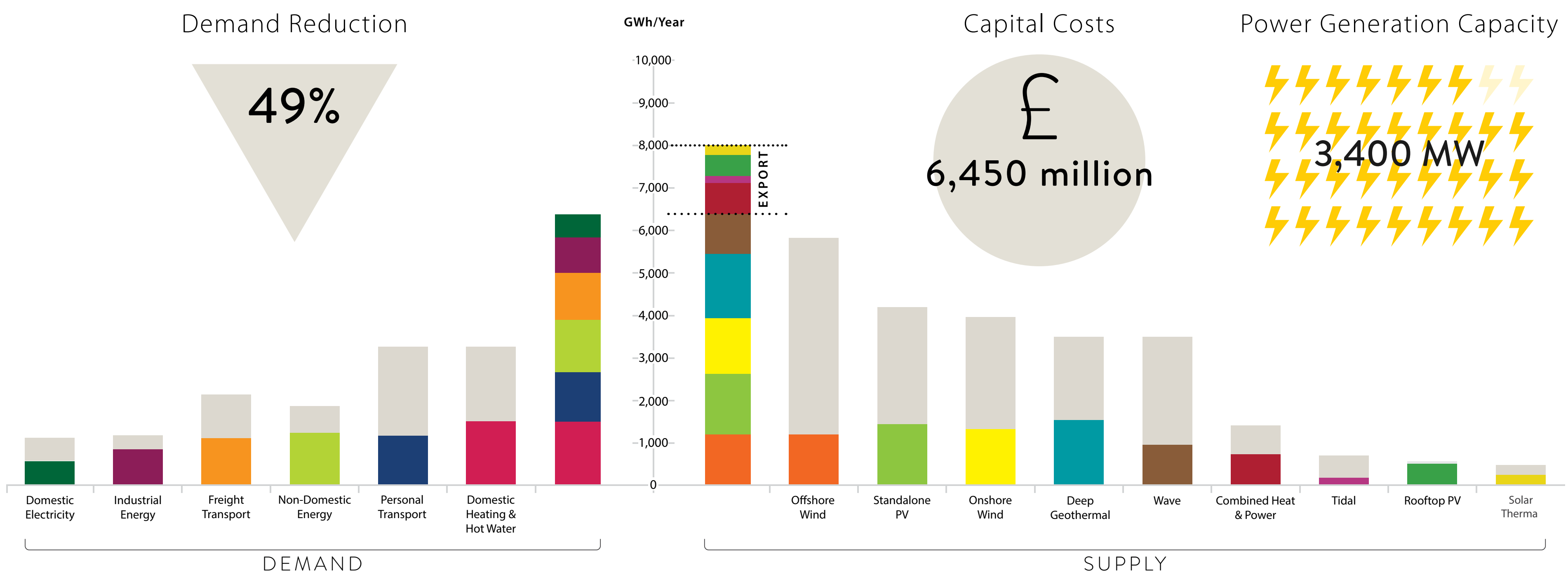
Due to this complexity, jobs were not represented within the Power Games. The graph on the left shows an estimate of the number of full time equivalent jobs that could be created in Cornwall, in the South West, and in the UK, based on the group scenarios from the Power Games workshop.

OUTCOME: POWER GAMES

The Power Games achieved general agreement to reduce demand by approximately 50% and increase supply to exceed the 2030 demand by 30%. This would lead to a net export opportunity. The consensus from the workshop was that this was a new and key finding, and an early indication of Cornwall's desire to control more of its energy infrastructure and to help the UK by exporting excess energy. The data from the Power Games session was fed back to participants the next day, and into the Call to Action session, which focused on understanding the barriers and drivers to achieving this objective, and identifying actions to be taken.

The diagram below summarises the average scenario selected by the groups, for the whole of Cornwall. On the demand side, the grey bars show business as usual demand, and the coloured bars show the reduced demands selected by participants. On the supply side, the grey bars show the total technical potential for that technology and the coloured bars show the average level of generation selected by participants.

Scroll over the vertical bars along the bottom of the diagram to see the statistics relating to each supply and demand technology.



EMPOWER

Call to Action

The second day of the workshop focused on a call to action. The day opened with a keynote speech from Professor Catherine Mitchell to put a focus on Cornwall in the context of UK energy policy. This was followed by a presentation of the results of the Power Games analysis which had taken place overnight, presented in the Power Games section above. Finally, before going into the call to action workshop, Professor Hugh Montgomery reflected on the global context for environmental action.

CATHERINE MITCHELL

PROFESSOR OF ENERGY POLICY, EXETER UNIVERSITY

The UK policy context

Energy is always political, and with the general election in May, at the time of the Cornwall Energy Island workshop this was particularly true for the UK. Professor Mitchell identified two main drivers for change in UK energy policy: top down, from the EU, and bottom up, from communities and local government, where people who are taking energy into their own hands are doing really interesting work. Cornwall is doing wonderfully at this.

Energy policy from the European Commission has two main drivers: for greater competition, and for sustainability. The drive towards competition is not taking us in the right direction, but the drive towards sustainability has many useful policies. A key policy is the 20:20:20 policy requiring a 20% reduction in CO_2 emissions, 20% of energy to come from renewables, and a target of 20% reduction in energy demand. The first two are binding, and Britain will have to pay substantial fines if we do not achieve our commitment within that. Commitments for each country for 2030 are in discussion.

There is also 'bottom up' pressure in the EU, with countries such as Denmark and Germany, as well as Italy, Spain and Portugal making fundamental changes in energy system operation and ownership. This contrasts with Britain where the energy policy supports the continued dominance of a few large companies, and the Electricity Market Reform Bill was primarily designed to support the construction of nuclear power stations, with renewables, demand side and community energy supported as a secondary goal.

Energy policy in the UK lacks legitimacy and transparency. The 2008 Climate Act is excellent, but we are still operating our energy system in the same way, and the most interesting changes are happening from the bottom up, with new entrants trying to supply energy differently, community energy groups, municipal energy initiatives.

There are two ways to change our energy system to achieve the outcomes we want. The first is through changing the institutions, rules and incentives, socially constructing the rules we want from the top down. The second is to show individually that we will do things differently, by becoming involved with the demand side and changing our patterns of behaviour to support a bottom-up approach.

HUGH MONTGOMERY

PROFESSOR OF INTENSIVE MEDICINE, UCL

The Global context

As an intensive care doctor, Hugh Montgomery works in a context where a lot of people die. Some who do so are young and fit when struck with an overwhelming 'hit'. Most, however, have accumulated a burden of illness before another becomes 'the straw that broke the camel's back'.

Likewise, the Earth has suffered a growing burden afflictions due to human activity. It took 540million years of multi-celled life before humans appeared, but only 150,000 for the human population to reach 1 billion. However, that population doubled in a little over 120 years, with another billion being added in only 33 years. There are now over 7billion people on the planet, and we add another billion every 12-14 years.

However, whilst the World's population has risen seven-fold since the early 1823, World GDP has risen over 350-fold. This economic activity is underpinned by a similar rise in humanity's use of natural resources- whether water, land, minerals, or animal wealth. Topsoil- needed to grow crops- may be all but exhausted from currently cultivated areas within 50 years. Much of the water we use comes from sealed fossil aquifers, many of which are (or will soon) run dry. We destroy habitats, pollute, and overhunt/fish. As a result, we are living through the fastest mass extinction the planet has ever seen: we have lost over 50% of vertebrate life on the planet in a little over 40 years, and up to 8 species become extinct every hour.

Such is the burden of chronic 'ill health' borne by the planet. And now we have climate change – the 'big force multiplier', the 'something else' that kills the sick patient. The physics of climate change – driven by greenhouse gases derived from human activity- is not in doubt. But we add more and more each year without heed to the fact that such gases will continue to warm the planet even if no more were released: a fifth of the carbon dioxide we release now will still be heating out atmosphere in 33,00 years' time and 7% will still be warming the planet in 100,000 years.

This warming matters to our ecosystems. But it matters to the health and survival of people of this and the next generation. The health impacts of climate change are catalogued in detail in the related Lancet Commissions of 2007 and 2015. These are mediated by altered bacterial growth, algal blooms, changes in vector-borne diseases, and changes in air quality (ground level ozone, pollen nature and burden), ground-level ozone. However, the main impacts are mediated through extreme weather events (whether flooding, drought, heat or cold). These lead to poverty, loss of habitation, flooding, and disease. They also cause crop failure, leading to starvation, migration and conflict.

We have no time left for inaction. What is needed is "granular" and "bold" decision making in Cornwall. The level of ambition needs to be that of the Apollo mission. Once NASA had announced there was going to be a man on the moon in a decade everyone had to deliver. Cornwall has been "dealt a perfect poker hand" of renewables: tidal drop, waves, wind, solar, biomass and geothermal potential abound. Cornwall just has to play it well. And if it can't be done in Cornwall, it can't be done anywhere. Cornwall should be a real world innovator whose reach can be far from just local. Cornwall can solve the problem for the UK and the rest of the world.

THE CALL TO ACTION SESSION

STRUCTURE

The second day focused on moving towards action, through a two part workshop on ‘Unlocking the Future’.

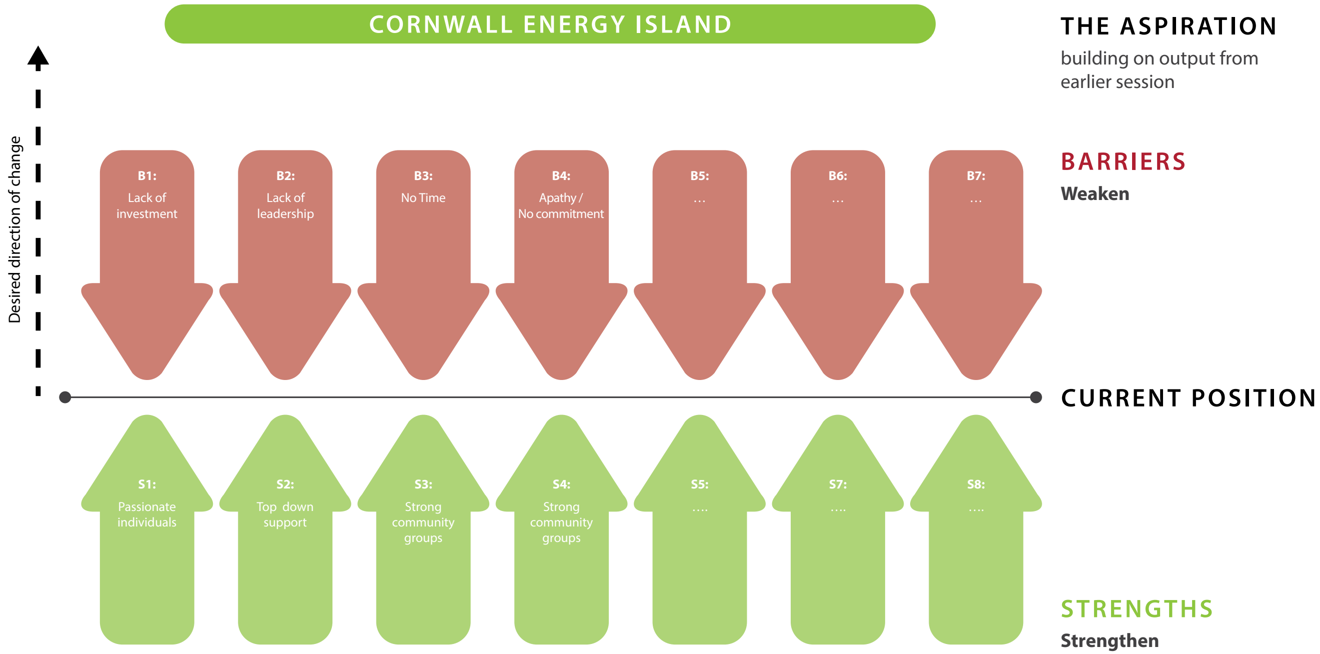
Groups focused on five different themes: leadership and governance; infrastructure; demand reduction; funding and finance; and skills and expertise. The first part of the workshop identified current barriers to progress, and strengths of the current situation. This was followed by a break, which allowed time for reflection, before the second part of the workshop which considered the actions that would address the barriers. These actions were organised by level of impact and ease of achievement, with those actions that are high impact being the priority actions to take forward.

For each theme, an objective or desired end state was identified, e.g. for leadership and governance the objective was to achieve: “the best leadership and management”.

AIMS OF PART 1
IDENTIFYING STRENGTHS AND BARRIERS

The aim of the first part of the workshop was to identify the main barriers which are preventing movement towards the objective, and then to identify the main strengths in the current situation which are creating momentum toward the objective. The opposing forces of the barriers, downward away from the objective, and the strengths, upward towards the objective, are shown visually in a 'force field' diagram, as shown below.

Example of a 'force field' diagram, showing barriers to achieving the aspiration, and strengths of the current situation which drive towards the aspiration.

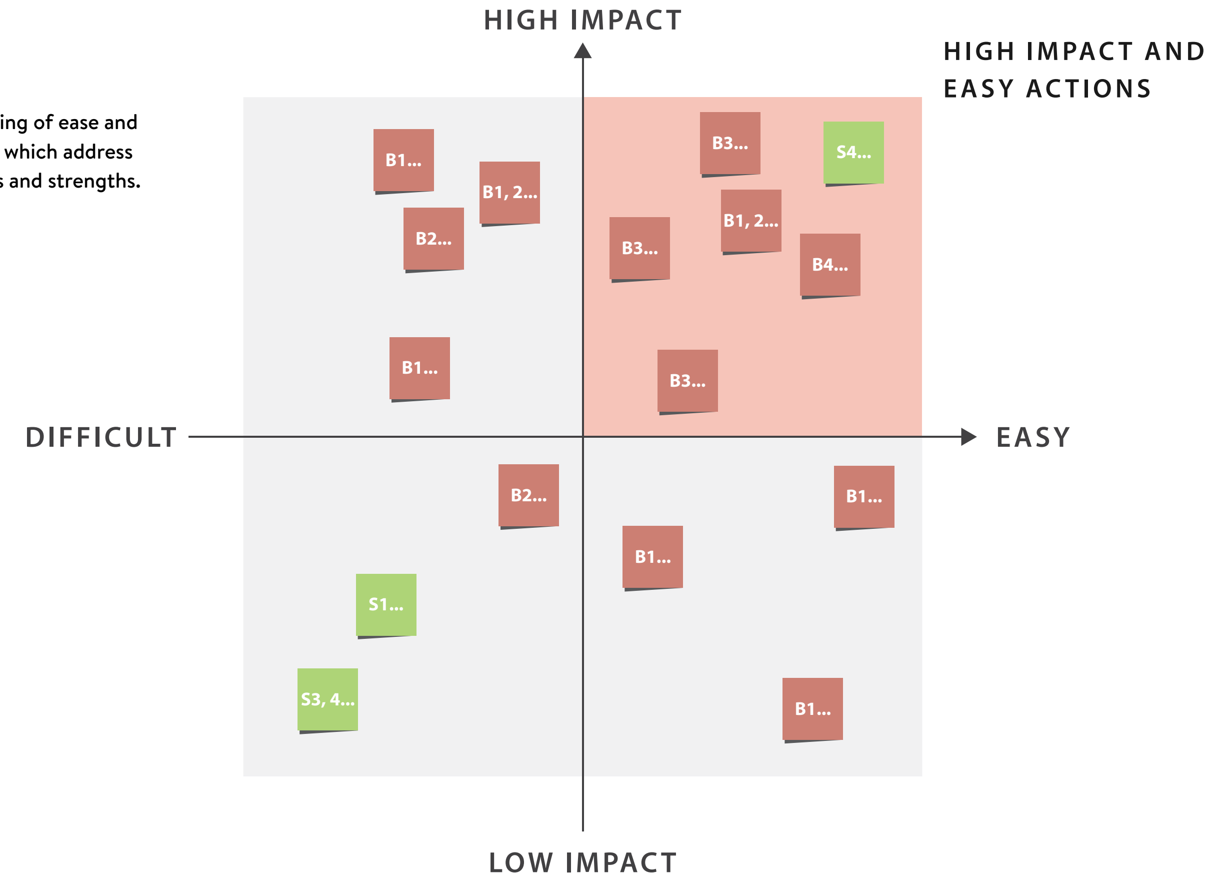


AIMS OF PART 2

ACTIONS, EASE VS IMPACT

The aim of the second part of the workshop was to identify actions that would weaken the barriers, and actions that would increase the strengths for movement towards the objective. Each action was linked to a particular barrier or strength, through numbering of post it notes. The actions were mapped in terms of how much impact they would have, and how easy they were to carry out, as shown in the diagram below. The key actions to take forward are those which are high impact and easy.

Example of mapping of ease and impact of actions which address identified barriers and strengths.



The following pages outline the key barriers, strengths and actions that emerged for each theme.

LEADERSHIP AND GOVERNANCE

One group considered leadership and governance, under the title “the best leadership and management”.

Key barriers and strengths

Barriers:

- Need for more resource for Cornwall Council to play a stronger coordinating and facilitative leadership role
- Need for increased communication between leaders to enhance coordinated action
- Insufficient understanding of the different roles needed from different organisations
- Uncertainty and instability in national energy policy and regulation.

Strengths:

- Strong strategy from Cornwall and IoS LEP and Cornwall Council, with ESIF capital to support this
- Cornwall’s identity, cohesiveness and independent spirit
- Relatively simple decision making due to only two Unitary Authorities
- Widespread leadership and motivation for change in communities, businesses and other sectors.

Key actions

Successful leadership and governance towards a Cornwall Energy Island will involve building on the existing strengths of Cornwall. This includes **strengthening the existing distributed leadership**, where each person and organisation makes the most of their capacities, and makes public statements of commitment. It also involves celebrating what is already happening, e.g. through the Cornwall Sustainability Awards.

There is also a need for **greater coordination**, as identified in the barriers. This could be achieved through increased support for the facilitative leadership role of Cornwall Council and the LEP, more sharing of knowledge with all stakeholders, and greater clarity on the roles of different organisations. The Devolution Deal for Cornwall published since the workshop, can support greater agency in Cornwall Council, which workshop participants noted was limited by central government.

Finally, committing to **a big project that everyone unites to deliver** can support the collaboration that is needed to make more ambitious change.

INFRASTRUCTURE

Two groups considered infrastructure, under the heading "The Infrastructure we need". The main focus of both of these groups was electricity infrastructure, although gas and transport infrastructure are also important for Cornwall.

Key barriers and strengths

Barriers:

- Difficulty for DNOs to invest ahead of demand, structure of who pays for infrastructure and how this is approached
- Grid designed to deliver energy from outside Cornwall, rather than distributed within Cornwall
- The high cost of the needed energy storage
- Issues coordinating with other infrastructure
- Lack of sufficient leadership and coordination
- Local opposition to renewable development
- Rapid changes and uncertainty in national regulatory context.

Strengths:

- Cornish identity, independence, ambition and ownership of renewable energy
- Cornwall Council relationship with DECC, Ofgem, National Grid and Western Power Distribution to discuss long term solutions
- Technology development and innovation projects taking place, including Active Network Management, leading to new entrants and disruptive business models and availability of superfast broadband to support this
- Ofgem consultation on Quicker and More Efficient Connections, with 'next steps' published September 2015.

Key actions

A number of themes emerged from the many actions proposed in the infrastructure session:

- The need for greater **communication** of current grid constraints and possible solutions, and sharing information with a wide range of stakeholders
- The need to **increase electricity grid capacity**, which requires a shift in regulation to allow investment ahead of demand – one suggestion was for Cornwall to be a pilot for alternative regulatory arrangements
- The need to support **electricity balancing**, through investment in storage and smart metering and data management
- The need for funding to enable studies and pilot projects
- The need for **greater local autonomy** such as a local version of DECC, prioritisation of community ownership in policy, an independent DNO, or private investment in grid infrastructure.

Some of these actions are supported by the Ofgem paper on quicker and more efficient connections published in September 2015. Cornwall stakeholders could propose to trial one of the proposed models.

All of these actions are underpinned by the need for **vision and leadership**, which was also a strong theme in this session. The Devolution Deal for Cornwall, and the ESIF funding calls under low carbon energy themes put Cornwall and IoS in a strong position to take this forward.

DEMAND REDUCTION

One group considered demand reduction, under the heading "Significantly Reduce Demand".

Key barriers and strengths

Barriers:

- Need for collective and social approach to change, rather than an individual one
- Difficulty of changing habits, lack of understanding of the need for change, and resistance to change
- High cost of energy efficiency and lack of funding, an insufficient business case for investment in energy efficiency
- High cost of finance for energy efficiency and lack of awareness of mortgage options for funding home improvements.

Strengths:

- Economic benefits of energy efficiency: cost competitive technology such as LED bulbs, low wage growth driving desire to save on energy, some availability of grant funding
- Council guidance on energy efficiency of historic properties, and energy efficiency advice given when buying and renting properties
- Increasing development and understanding of technology e.g. insulation and thermostats.

Key actions

Achieving demand reduction will require **practical schemes** such as collective buying of LED bulbs, vision and leadership from the bottom up and from Cornwall Council and the LEP, and **awareness raising** on fuel poverty, the benefits of energy efficiency and climate change, through a variety of channels: media such as Western Morning News Radio Cornwall, a campaign, recruitment of credible champions, and through exemplars and practical projects.

Enterprise is also important: participants mentioned action on developing and celebrating local, community and social energy enterprises, the development of local energy markets, and potentially a Cornwall Energy Company.

FUNDING AND FINANCE

Two groups considered funding and finance, under the heading "The best funding and finance mechanisms". Funding and finance was also mentioned by a number of other groups as part of their discussions e.g. demand reduction, infrastructure and skills, technology and expertise.

Key barriers and strengths

Barriers:

- Uncertainty in policy, regulation, future energy price and planning risk and lack of clarity on state aid and EU funding requirements
- Low political interest in the topic at local and national levels
- Lack of understanding of renewable energy by some financial institutions, of business risk by some investors, and need for viable commercial models and opportunities to invest at scale
- High cost of loans for energy efficiency and lack of awareness of potential to use mortgages to fund energy efficiency and renewables
- Competition for limited funding.

Strengths:

- Natural resources and higher return on renewable energy with Feed in Tariffs, Renewable Obligation Certificates and Contracts for Difference in Cornwall than elsewhere
- Leadership and motivation in businesses, community, council and LEP, social capital, community spirit
- Cornwall Council's revolving fund, and planning prioritisation of community ownership
- Finance is available e.g. pension funds seeking long term returns.

Key actions

Participants proposed actions relating to:

- **How to get funding**, such as developing a costed plan with a clear business case, developing a cross-party campaign, and a prospectus for Cornwall
- Ideas about **sources of funding and finance**, including private sector, community and crown funding, LEP, Green Investment Bank, ESIF, central government, and potentially setting up a Cornwall Bank or Cornish Infrastructure Fund
- Ideas of **what to fund**, such as energy efficient refurbishment of housing, deep geothermal energy, alternative vehicle fuel development, research and modelling to develop a plan for Cornwall's energy system, and seed funding a Cornwall Energy Company or ESCO
- Actions for **the funding process**, including at risk development funding, generate funding practice over time, aggregation of funding, media, press and champions, loud independent business voice.

SKILLS, TECHNOLOGY AND EXPERTISE

Two groups considered skills, technology and expertise, under the heading "The right skills, technologies and expertise". The focus in both of these groups was on skills, education and jobs, rather than on technology.

Key barriers and strengths

Barriers:

- Low salaries and pay levels
- Lack of opportunities for skilled work
- Cornwall's 'end of the line' location, with lack of infrastructure, connectivity and transport
- These result in a 'brain drain' from Cornwall.

Strengths:

- Entrepreneurial, skilled and motivated workforce, particularly among the young
- Location near to natural resources for energy, particularly marine
- Strong research and teaching sector, with universities, further education colleges, apprenticeships
- Motivated community with 'just do it' spirit as shown by number of community groups
- Quality of life in Cornwall, with beauty of natural environment.

Key actions

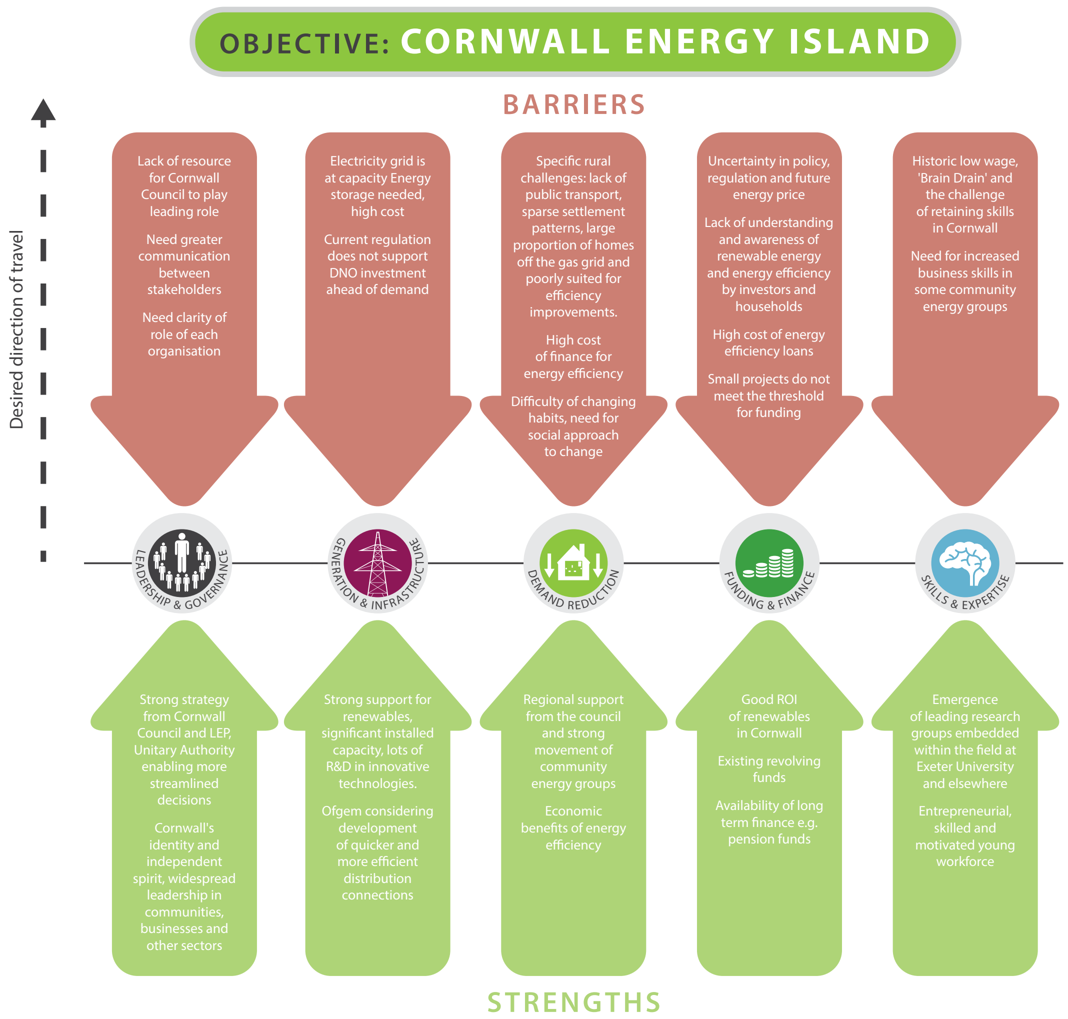
Key actions can be grouped into three themes:

Attracting and retaining talent: including increasing salaries and wages; reducing cost of living through investing in public transport and energy efficient housing; celebrating the quality of life in Cornwall; attracting industry and manufacturing to Cornwall.

Training and education: including colleges developing practical skills training in the renewables industry, and universities increasing their focus on energy related skills, and encouraging masters and PhD level research on energy.

Vision, branding and leadership: promoting Cornwall as a centre of green economic development, innovation and renewable energy, and promoting a Cornwall Energy Island vision with targets for green jobs, renewable energy deployment etc.

OUTCOME: BARRIERS AND STRENGTHS



The diagram to the left summarises the key barriers and strengths for achieving the overall goal of a Cornwall Energy Island, for each of the themes discussed in detail in the groups.

Leadership and vision are considered as both a barrier and a strength in many of the themes, not just under the theme of leadership and governance. It is recognised that there is strong motivation in communities, businesses, Cornwall Council and the LEP to develop renewable energy and energy efficiency. There are also many examples of collaboration, such as the infrastructure discussions taking place between Cornwall Council, Western Power Distribution, National Grid, Ofgem and DECC. However, improving the quality and coordination of this leadership could unlock movement across all five themes.

Regulation is also a cross cutting issue, with uncertainty in regulation and policy a key barrier to accessing finance and funding, and regulatory change needed to enable more strategic investment in infrastructure.

The unique characteristics of Cornwall are both a strength and a barrier – the natural resources, quality of life, and independent identity of the Cornish people support a sustainable energy future for the county, whereas the lack of connectivity and transport links are a challenge for demand reduction and attraction and retention of skills and expertise.

It is well known that doing anything requires money, so it is not surprising that finance and funding was mentioned in many of the themes, as well as the finance and funding theme itself.

OUTCOME: KEY ACTIONS

1

CREATE A POWERFUL VISION FOR A CORNWALL ENERGY ISLAND FUTURE

Stories are powerful, and the workshop participants had many suggestions for ways that we can tell the story of Cornwall's energy future.

- **Change is happening** - people are recognising the importance of climate change, and the need for a shift in how the energy system is operated
- The Cornish landscape has seen many **phases of industry** – it is time to embrace the next one
- A renewable based energy future for Cornwall can lead to **affordable energy and happy people**
- We need to **celebrate achievements**, and build on existing strengths – the Cornish sense of independence and 'just do it' spirit
- Wide support is needed – telling the story through a variety of media, and through Western Morning News Radio Cornwall, creating an inspiring **'prospectus for Cornwall'**, an inspiring green brand of Cornish innovation
- The change needed is at a social, not an individual level, and **collective action** can be much more powerful than the sum of its parts.

2

INCREASE THE ELECTRICITY GRID CAPACITY FOR CORNWALL

We know that the electricity grid in Cornwall is full for further connection of renewable energy. We can be smart about how we deal with this.

- Develop **smart grids, storage and demand response** to make the most of the existing infrastructure and renewable resources
- Communicate grid constraints more clearly and in more geographic detail, and make a **technical plan**
- Build on existing conversations between Cornwall Council, WPD, Ofgem and DECC to test models for **investment ahead of demand**
- Support energy **storage** as part of grid reinforcement policy.

3

CREATE MORE COORDINATED LEADERSHIP

There are many people leading the creation of Cornwall's energy future. The involvement of a diversity of stakeholders, and the distributed nature of leadership is a strength, but can also be fragmented and lack coordination.

- Strengthen **bottom up leadership**, supporting community ownership and action
- Increase **trust, build relationships**, and create opportunities for **collaboration** through a Cornwall Energy Island forum
- Recognise the **key role of Cornwall Council** in providing leadership and facilitation
- Develop greater **clarity about the roles** of different stakeholders.

4

TRAIN, ATTRACT AND RETAIN MORE SKILLED WORKERS THROUGH EDUCATION, INCREASED WAGES AND BETTER PUBLIC TRANSPORT

Colleges and universities play an important role in developing the next generation of skills. There is also a 'demand side' challenge to overcome: the low wages, lack of public transport, distance from the rest of the UK, and cost of living make it difficult to attract and retain skilled people in the county.

- **Increase wages** to attract and retain skilled workers
- Engage with **graduates of universities and colleges** in Cornwall to attract them to stay
- Recognise that energy efficiency of housing **could reduce the cost of living**
- **Invest in public transport**, to reduce the sense of isolation and cost of commuting
- Celebrate the **high quality of life** in Cornwall, including the natural beauty and green space.

5

JUST DO IT: MAKE THE ENERGY ISLAND HAPPEN THROUGH PILOT PROJECTS, INNOVATION AND EXEMPLARS.

An energy island means balancing supply and demand. Learning by doing is powerful, with pilot projects led by local community groups and Cornwall Council, in collaboration with WPD, Wales and West Utilities and local, national and global businesses.

- **Bottom up activity** is already happening, testament to Cornwall's 'just do it' spirit. This could be further enabled and supported through funding, endorsement and national government support
- Choosing **a big project to unite** around could bring different stakeholders together in collaboration
- Cornwall could be a test bed for **innovative electricity grid reinforcement** approaches
- **Global businesses and investors** could be attracted to invest in Cornwall and enable projects to get off the ground
- Local policy, funding and incentives for **energy efficient refurbishment and smart meter deployment** can build momentum to make this happen fast in Cornwall
- A new organisation such as a **Cornwall Energy Company** could provide a vehicle for getting things done.

6

PROVIDE FUNDING AND FINANCE TO PROJECTS

Ensure availability of development funding, address the cost of capital, interest levels on loans, and perceptions of risk and viability by banks and other lenders.

- Create a **funding aggregation body** to support multiple small projects to access larger pots of funding
- Make available **low interest finance** for home energy efficiency improvements
- Encourage **mortgage lenders to recognise** that energy efficiency and renewable energy add value to a home and reduce borrowers' outgoings
- Raise awareness among households that increased **mortgages are an option** for energy efficiency financing
- Develop **strategic plan for Cornwall's energy system** with a model of the system in 2030 to develop the business case for investment
- **Grow existing community and crowd funding initiatives** e.g. The Low Carbon Society
- Make the most of the ESIF funding, with **greater clarity on how this is to be used** and how to access it
- Set up a **Cornwall Bank** or Cornish Infrastructure Fund.

7

ENGAGE AT A NATIONAL LEVEL IN DEVELOPMENT OF POLICY AND REGULATION

Much can be done in Cornwall, but there is also a need to look beyond, to the national policy and regulatory context which both enables and limits what can be achieved locally. This is also the opportunity for lessons from Cornwall to catalyse action more widely across the UK and beyond.

- Identify the ways in which **policy and regulation** blocks the Cornwall vision and find solutions to this
- Increase the agency of the Unitary **Authority** to allow greater local control, through the devolution deal
- **Look beyond the UK** to learn from other countries e.g. Germany, Japan, California
- Find ways to navigate national policy and regulatory instability and uncertainty.

MOMENTUM IS BUILDING

The energy landscape is changing, and this is the time for Cornwall to decide how to interact with this change to capture the benefits. We are at a crossroads in terms of how we move towards the concept of an energy island. Since the Energy Island event in March 2015, there have been a number of positive developments in Cornwall, as well as a changing policy context nationally:

- Cornwall has secured a Devolution Deal with a strong energy theme, including further support for community energy, grid reinforcement, geothermally heated Enterprise Zones, and locally delivered energy efficiency
- Low Carbon projects in Cornwall and IoS are now being funded through ESIF, developing projects on marine renewables, deep geothermal, low carbon heat and local energy markets
- Cornwall Council is assessing the feasibility of district heating in Cornwall, funded by the Heat Networks Delivery Unit
- A number of innovative pilot projects have been developed, for example the Sunshine Tariff trial in Wadebridge, with WPD, RegenSW, WREN, Tempus Energy
- Cornwall Council has started the process of setting up a Cornwall Energy Company
- Ofgem has consulted on Non-Traditional Business Models, and there is a national appetite for removing barriers to entry for the energy market.

OUTCOME: THE VISION

Through the Energy Island process we managed to define the following vision:

To harness Cornwall's renewable resources, to halve energy costs and double new jobs by 2030.

Of those who responded to the survey, 90% endorsed this vision.
We are now working with Cornwall Council on specific parts of this plan.

5. ENERGY ISLAND: GLOBAL APPLICATIONS

TAKING THE ENERGY ISLAND ELSEWHERE

Feedback from participants involved in the Cornwall case study has demonstrated the Energy Island approach can be successfully applied to structure dialogue and define future energy scenarios and actions for a region.

We started by **enthusing** participants, with a series of inspiring keynote speeches. The workshop brought together a wide range of expert and non-expert stakeholders, and the next step was to **educate** each other by sharing knowledge between different specialists and raising the general level of understanding of non-experts. During the **energise** session, the Power Games provided an engaging arena for gaining a clear picture of the areas of consensus, and the areas of unresolved debate about how best to reduce demand and increase local energy supply. It also created a clear vision for a Cornwall that exports renewable energy and makes a contribution to the rest of the UK, importantly a vision that was created together by many stakeholders. The call to action session explored both the barriers and the drivers for achieving this vision, and showed how powerful it can be to focus on removing barriers. The actions identified **empower** participants to take forward a plan for a Cornwall Energy Island. This plan, if taken forward, can lead to jobs, recycle money in the region, and provide local energy resilience.

We believe this approach can also be applied in many contexts: in a city-region, in a true remote island, in land-locked rural areas. Each will bring its own challenges and constraints, and reveal different interdependencies. We have recently applied Energy Island thinking to the more densely populated and urban area of the West of England, and this demonstrates the importance of the relationship between different geographical areas: whereas Cornwall was able to export up to 30% above its energy demand, the West of England is reliant on external sources of energy to meet its needs.

Starting at the local level allows the possibilities to be explored in the granular detail that enables action. It raises the level of understanding of local stakeholders and brings them together as a coalition of advocates. It also reveals the changes that are needed at a higher level: regional trade and collaboration, national policy and regulatory changes, international electricity interconnectors, global climate change agreements and sharing of innovation taking place in different localities. The Energy Island approach can be powerful in many contexts, considering both top-down and bottom-up approaches, focusing on the local without being parochial.

If you would like to discuss how Energy Island Thinking can be applied in your region, please get in touch.

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This project would not have been possible without the hard work and commitment of many people.

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And finally to everyone who participated in the workshop, shared their knowledge, insights, ideas and dreams for what Cornwall can become.

IN PARTNERSHIP WITH

eden project

The Eden Project, an educational charity, connects us with each other and the living world, exploring how we can work towards a better future.

Our visitor destination in Cornwall, UK, was built in an ex-china clay pit to demonstrate that devastated landscapes can be restored. Here, geodesic Biomes housing the largest rainforest in captivity, exhibitions and stories serve as a backdrop to contemporary gardens, concerts and year-round family events. Registered charity number 1093070 (The Eden Trust).
Money raised supports our transformational projects and learning programmes.

EVENT SPONSORSHIP FROM

REHAU
Unlimited Polymer Solutions

REHAU is an innovative polymer company who specialise in low energy solutions, manufacturing products that are used to reduce energy demands from buildings, as well as energy creating solutions. From the Passivhaus approved REHAU GENEO window system to earth tubes and collector pipes for ground source heating, we also offer a UK manufactured district heating pipe. The Cornwall Energy Island event was an ideal opportunity to showcase our exciting range of products, with Cornwall & the South West being at the forefront of the adoptions of these systems for many years. We were able to strengthen our connections within the region and the event also gave us an opportunity to meet a number of new and interesting delegates. REHAU have also developed a strong relationship with BuroHappold and felt it helped us cement relationships by supporting them in this exciting project.

solarcentury

Solarcentury is one of the world's long-standing solar companies, with a reputation for innovation and quality. Solarcentury recognised that its own mission of making a meaningful difference in the fight against climate change by promoting the widespread adoption of solar, was well aligned with the goals of the Cornwall Energy Island conference. We were keen to support the conference in identifying solutions to issues such as grid infrastructure, energy storage, community engagement, investment and in influencing energy policy.

Solarcentury has long standing links with Cornwall; from designing and installing the aesthetic solar roof of the Core Building at the Eden Project in 2006, to the first UK large-scale ground mounted system in 2011 at the site of a disused tin mine at Wheal Jane. Solarcentury has also undertaken two large rounds of work with Cornwall Council, installing roof top solar systems across the Council's building portfolio.

BUROHAPPOLD ENGINEERING

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