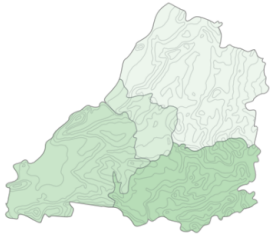


ZERO WEST

A collaboration to accelerate
the transition to a zero-carbon society
in the West of England

zerowest.org

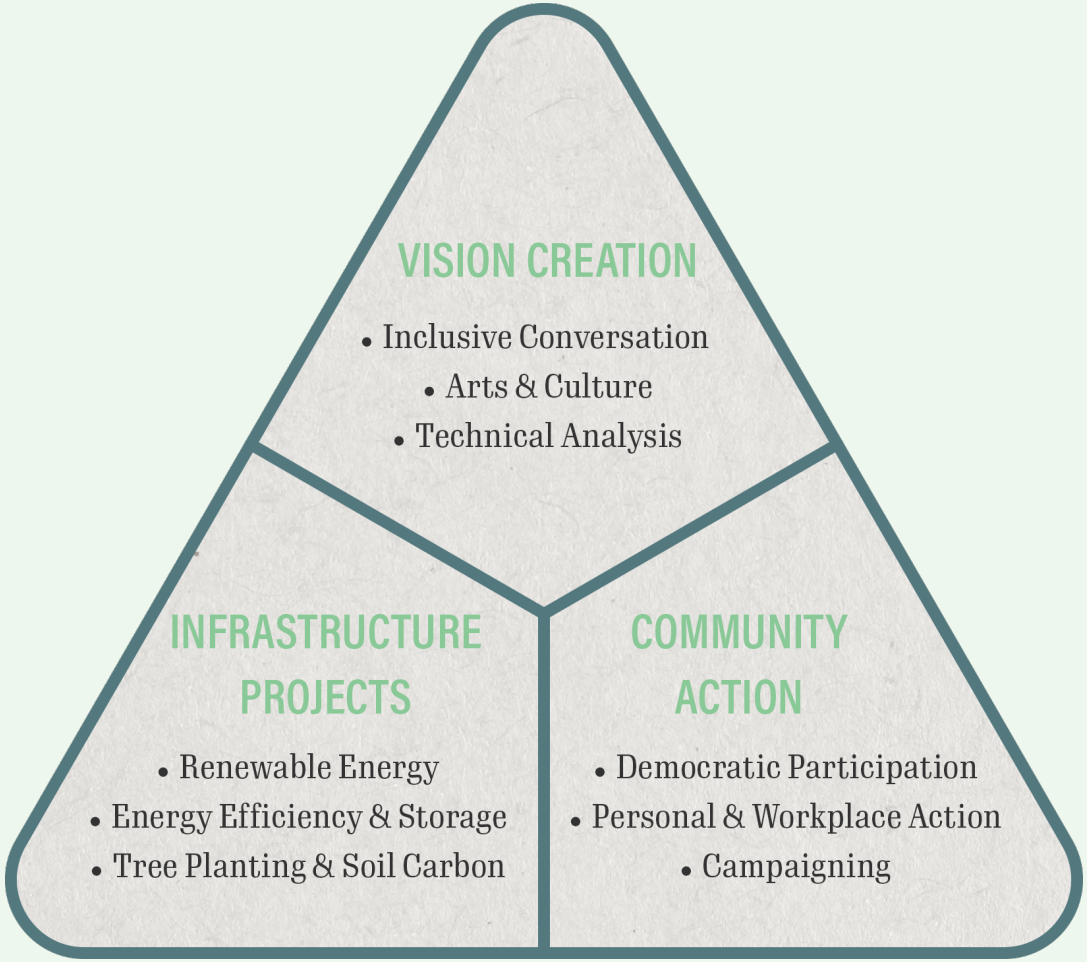
@ZeroWestCIC

Zero West CIC

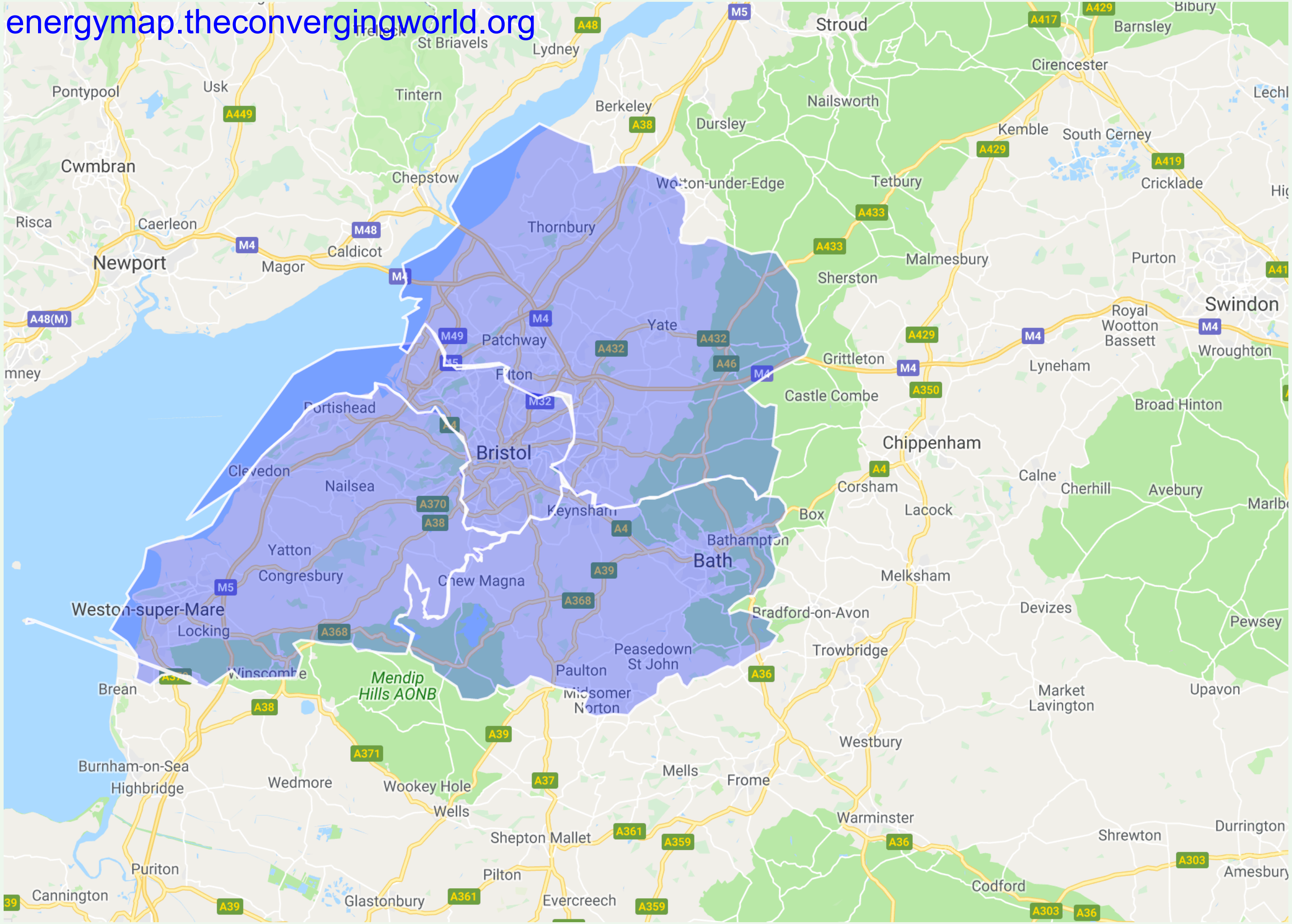
Zero West's purpose is "to work in an inclusive and collaborative way to achieve a West of England that is **zero carbon, zero waste, prosperous, and fair.**"

Individual and organisational members

Connecting across sectors - we need to do this together.


VISION CREATION
• Inclusive Conversation
• Arts & Culture
• Technical Analysis
INFRASTRUCTURE PROJECTS
• Renewable Energy
• Energy Efficiency & Storage
• Tree Planting & Soil Carbon
COMMUNITY ACTION
• Democratic Participation
• Personal & Workplace Action
• Campaigning

Energy and Land Systems for Climate Adaptation *in the West of England and the UK*


energymap.theconvergingworld.org
St Briavels
Lydney
Stroud
Bibury
Barnsley
Cirencester
Pontypool
Usk
Tintern
Berkeley
Nailsworth
Dursley
Lechl
Kemble
South Cerney
Cwmbran
Chepstow
Wotton-under-Edge
Tetbury
Cricklade
Risca
Caerleon
Thornbury
Newport
Caldicot
Magor
Malmesbury
Purton
Sherston
Swindon
Royal
Wootton
Bassett
Yate
Patchway
Grittleton
Lyneham
Wroughton
mney
Filton
Castle Combe
Broad Hinton
Portishead
Chippenham
Bristol
Clevedon
Nailsea
Calne
Cherhill
Avebury
Corsham
Lacock
Keynsham
Box
Marlb
Bathampton
Yatton
Bath
Congresbury
Melksham
Chew Magna
Weston-super-Mare
Locking
Bradford-on-Avon
Devizes
Pewsey
Peasedown
St John
Trowbridge
Paulton
Mendip
Hills AONB
Midsomer
Norton
Brean
Market
Lavington
Upavon
Westbury
Burnham-on-Sea
Highbridge
Wedmore
Wookey Hole
Wells
Mells
Frome
Warminster
Shepton Mallet
Shrewton
Durrington
Puriton
Pilton
Amesbury
Cannington
Glastonbury
Evercreech
Codford
M5
M4
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A433
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A46
A350
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A368
A36
A371
A37
A361
A359
A303
A48(M)

Methodology

1. Estimate renewable potential for WoE region
    a. Roof & Ground Solar
    b. Onshore & Offshore Wind
    c. Hydro
    d. Biomass and Energy from Waste (EfW)
    e. Anaerobic Digestion (AD)
2. Estimate existing renewables in WoE region
3. Parameterise Pathfinder Model by Wales & West Utilities

Scope

- Pathfinder includes:
  - Electricity - domestic, commercial, industrial
  - Gas - domestic, small commercial, electricity generation
- Pathfinder baseline calculates 3.8 tonnes CO2/person
- UK figures: 5.5 tonnes CO2/person (DUKES 2019)
- Difference is industrial gas and transport (major contributor)
- Per capita consumption is 10-15 tonnes CO2 per person
- *A quarter to a half of emissions for which we are responsible?*

Potential Renewables

- Solar (roof) - 4kW on 25% of roofs
- Solar (ground) - **0.5% land area**
- Hydro - Environment Agency methodology
- Wind (onshore) - Regen SW methodology (2010) - **3% land area**
- Wind (offshore) - share of national capacity contracted by 2030
- Biomass - 20% agricultural land - **14% land area**
- EfW - 2030 projected recycling rates
- AD - 10x current capacity

Existing Renewables

- What renewables do we have where is not a simple question!
- Data we use:
  - Feed In Tariff data from OFGEM
  - Renewable Energy Planning Database
- Thanks to Sheffield Solar Group
  - https://www.solar.sheffield.ac.uk/
- Notes on project status:
  - Biomass and EfW - operational or planned projects only
  - Solar, wind and hydro - projects may have been abandoned

Results

Capacity (MW)	S Glos	Bristol	B&NES	N Somerset	TOTAL	EXISTING
Solar PV (roof)	137	260	108	125	631	101
Solar PV (ground)	248	55	176	187	666	188
Hydro	0	1	4	0	5	0
Onshore Wind	167	0	114	132	412	65
Offshore Wind					782	155
Biomass	16	0	10	11	37	0
EfW	12	17	9	10	49	102
AD					170	17

Modelling I

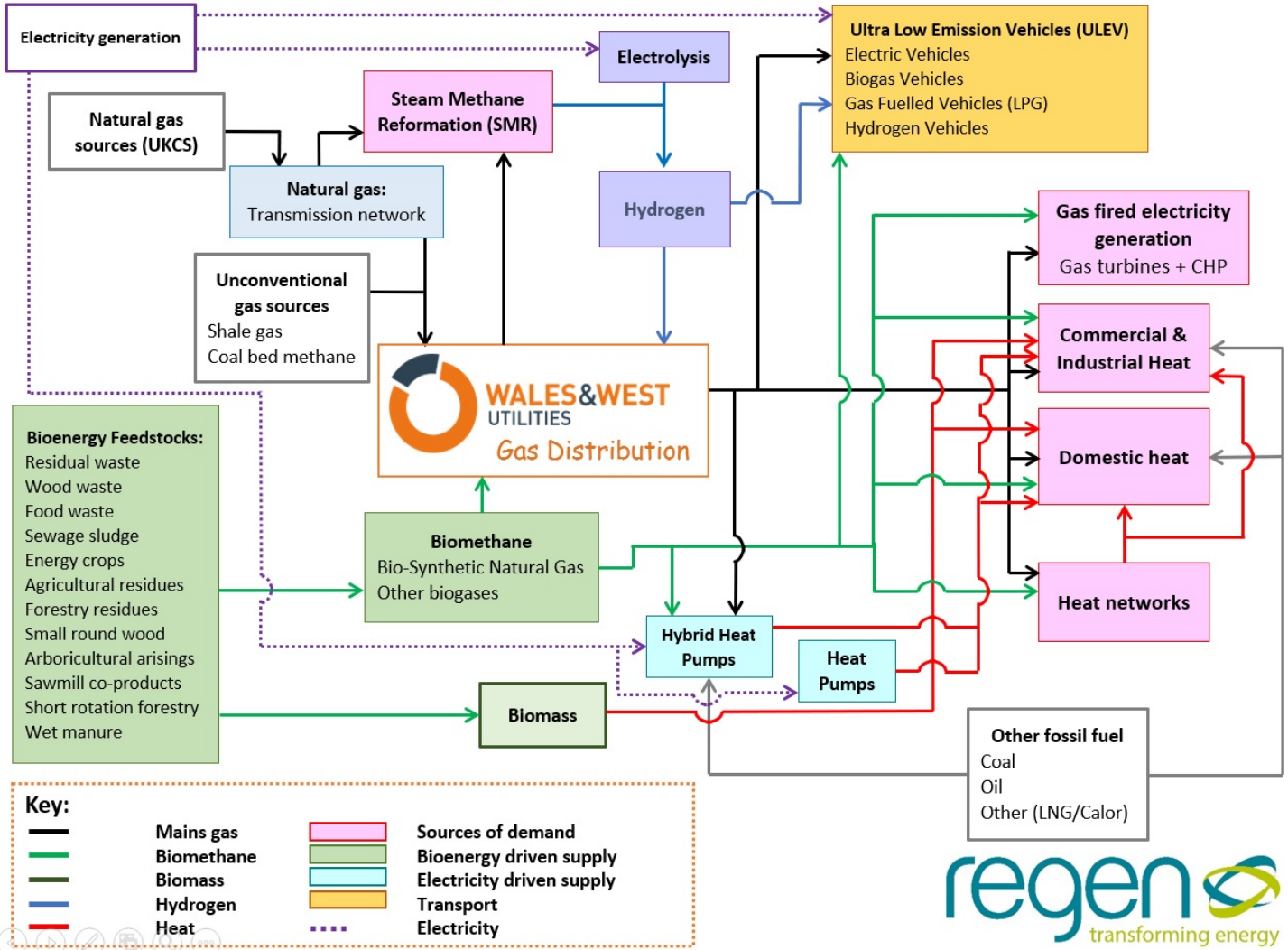
- Model
  - Pathfinder by Wales & West Utilities
  - Hourly supply and demand matcher with historical data
- Baseline
  - National figures, reduced proportionally by population for the WoE
- Scenario
  - No fossil fuels of nuclear
  - Reduce demand by ⅓
  - Ambitious local solar and wind, share of planned offshore wind
  - Current EfW, no biomass, share of national hydro
  - One electric car per household (current: ~1.4 cars/household)
  - Batteries accompanying rooftop solar
  - Heat pumps & green gas from increased AD
  - Excess renewables used to generate hydrogen

Modelling II

- How much renewable energy is this?
  - ~1.5x the generation capacity
  - Overall electricity demand in baseline and scenario is similar
- And what do we do with it?
  - With 80% heat pump (and 20% direct electric) heating:
    - Rely on ~500GWh interconnector import
    - With 500MW+ H_2 generation, store ~500GWh H_2 with zero export
    - Minimal fossil gas/CO_2 emissions
  - And by being smart:
    - With smart heat pumps, and smart electric vehicles...
    - We can reduce interconnector dependence by a factor of 10
    - Though occasional reliance remains high
- The West of England can achieve zero carbon

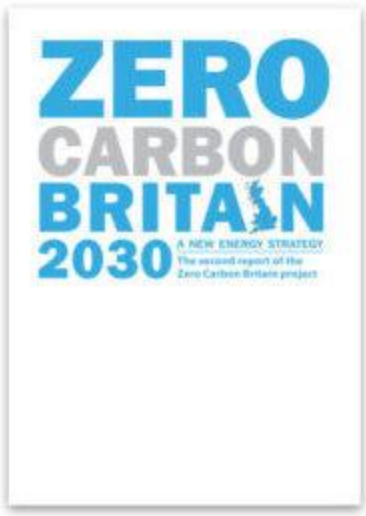
The Future of Energy

- We need significantly more renewables
- We need significant demand reduction
- We also need...
  - Electric vehicles including fleet utilisation
  - Heat pumps & domestic batteries
  - Biomethane & hydrogen generation and storage
  - Conversion of hydrogen to synthetic gas & liquid fuels
  - Reforestation and regenerative agriculture
- We shouldn’t need:
  - Fossil fuels & nuclear
  - Old growth forests for biomass
  - Carbon capture & steam reformation


Electricity generation
Electrolysis
Ultra Low Emission Vehicles (ULEV)
Electric Vehicles
Biogas Vehicles
Gas Fuelled Vehicles (LPG)
Hydrogen Vehicles
Natural gas sources (UKCS)
Steam Methane Reformation (SMR)
Natural gas:
Transmission network
Hydrogen
Gas fired electricity generation
Gas turbines + CHP
Unconventional gas sources
Shale gas
Coal bed methane
WALES&WEST UTILITIES
Gas Distribution
Commercial & Industrial Heat
Bioenergy Feedstocks:
Residual waste
Wood waste
Food waste
Sewage sludge
Energy crops
Agricultural residues
Forestry residues
Small round wood
Arboricultural arisings
Sawmill co-products
Short rotation forestry
Wet manure
Biomethane
Bio-Synthetic Natural Gas
Other biogases
Domestic heat
Heat networks
Hybrid Heat Pumps
Heat Pumps
Biomass
Other fossil fuel
Coal
Oil
Other (LNG/Calor)
Key:
Mains gas
Biomethane
Biomass
Hydrogen
Heat
Sources of demand
Bioenergy driven supply
Electricity driven supply
Transport
Electricity
regen
transforming energy

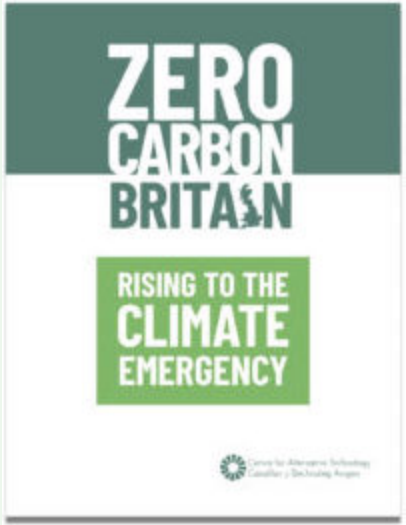
Reports by the Centre for Alternative Technology

[cat.org.uk](cat.org.uk)



2010

2014



2019

2018

2017

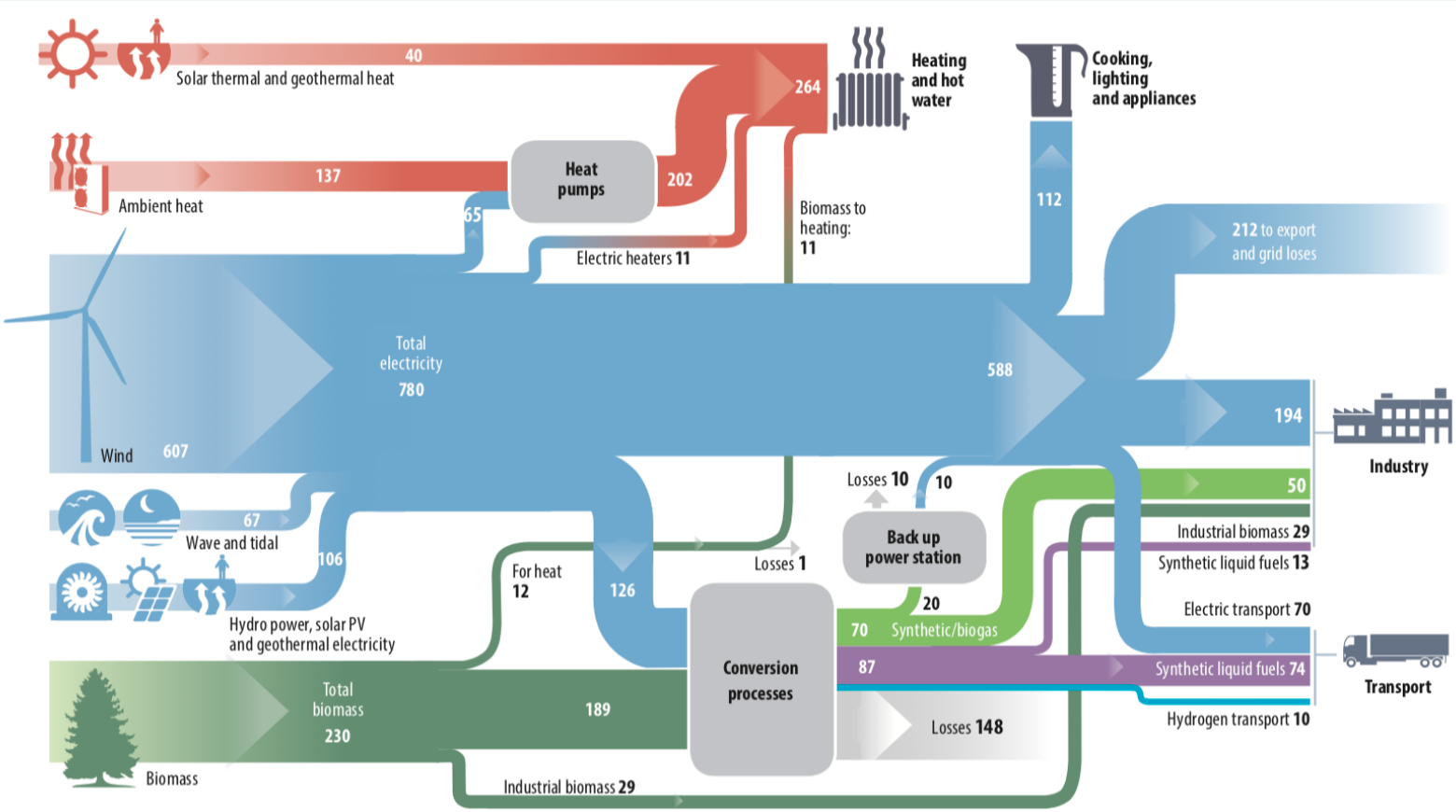
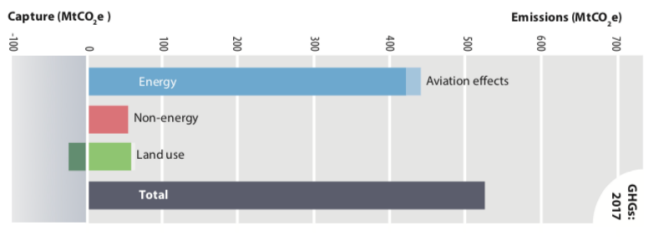
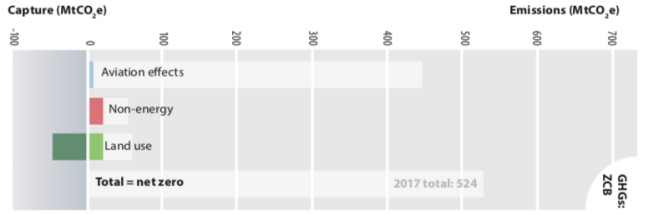
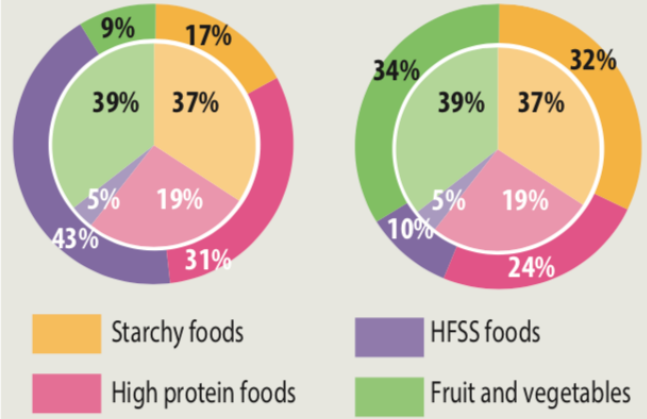
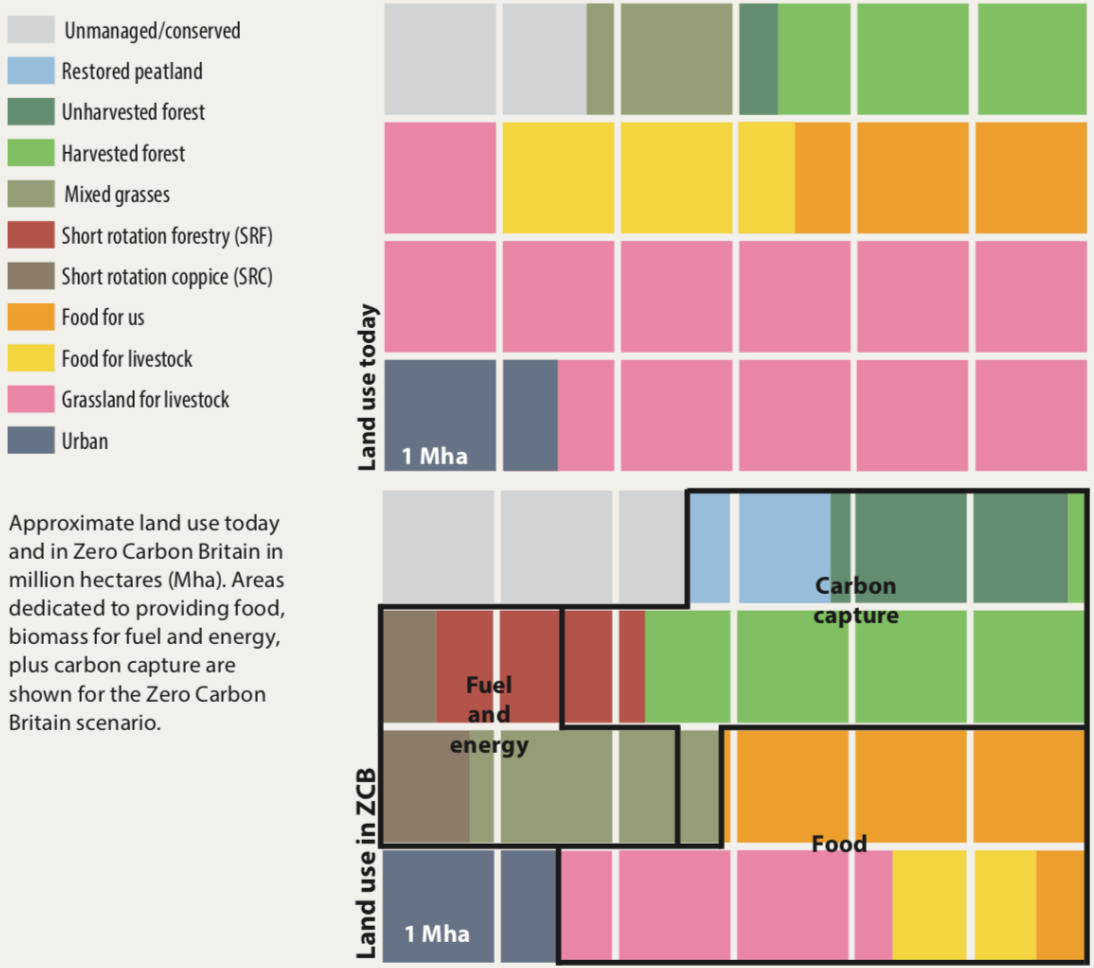


Figure 3.18: Energy flows in our scenario – from supply to demand. Numbers used here are rounded up or down to the nearest TWh and so inputs and outputs may not add up exactly.









Approximate land use today and in Zero Carbon Britain in million hectares (Mha). Areas dedicated to providing food, biomass for fuel and energy, plus carbon capture are shown for the Zero Carbon Britain scenario.

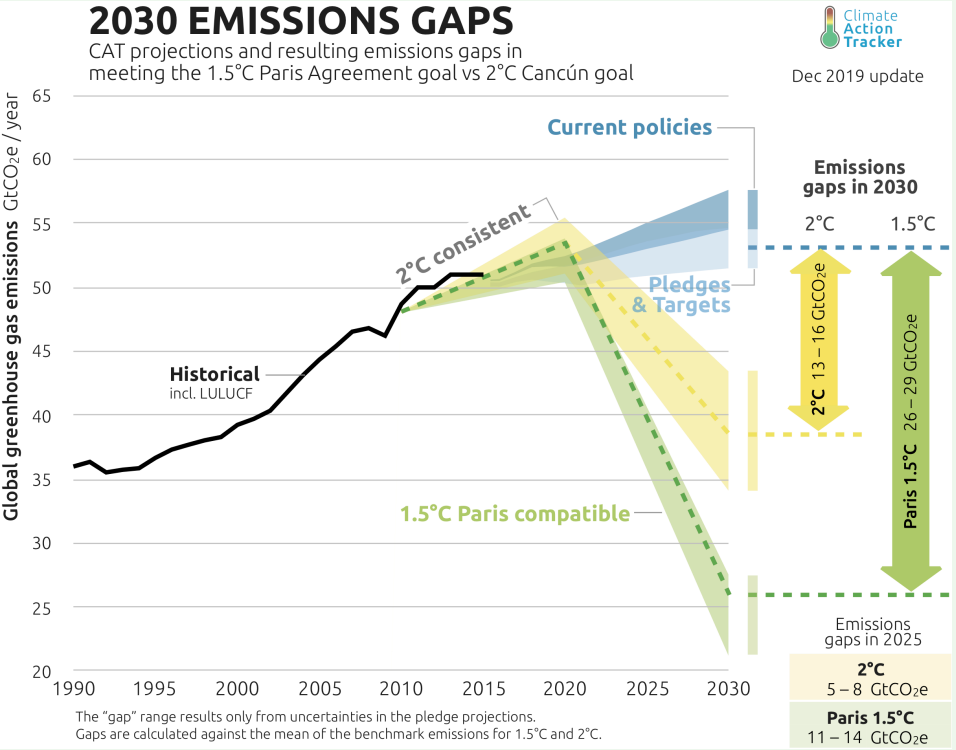
Land use in the West of England

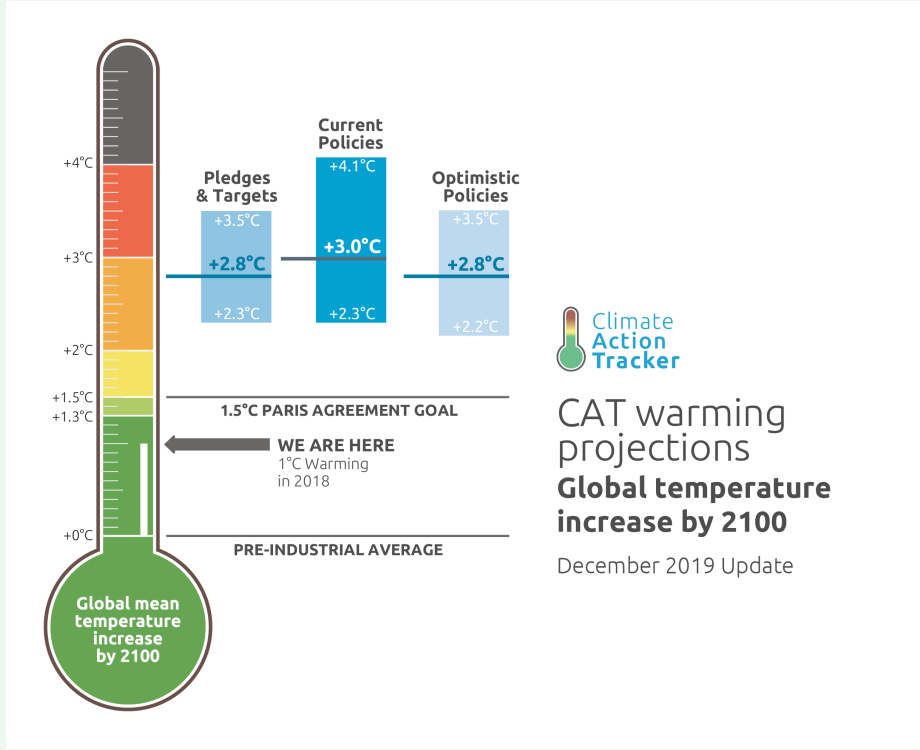
- WoE is 71% agricultural land and 6% forestry
- New forestry: 400 tonnes CO_2/hectare/50 years (Woodland Trust)
- Reforesting WoE: ~1 million tonnes CO_2 sequestration/year
    - https://www.avonneedstrees.org.uk/
- Regenerative agriculture: 60-120 tonnes CO_2/hectare
    - https://www.drawdown.org/solutions/food/regenerative-agriculture
- Regenerative agriculture in the WoE: 6-12 million tonnes CO_2

Key Messages

- No doubt as to technical feasibility of achieving zero carbon
- The transition required is extremely complex
- It is also occurring *piecemeal* and against *fundamental* blockers
- The financial cost will be high
- We must now reduce emissions *and* sequester carbon (no offsetting)
- We must reduce emissions *beyond* our responsibility
- In these sectors: **heat & power** / **transport** / **food & stuff**
- Why does it matter?

We have less than ten years of carbon budget for a ⅔ chance of remaining below 1.5 degrees





Zero Carbon means every person and organisation doing everything in their power to reduce emissions now