

Energy and Disability:

Improving home retrofit
for Disabled people and
caregivers

Appendices

September 2025

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Appendix 1: Literature review method

Research questions

1. What are the barriers that Disabled people experience (or anticipate experiencing) in the energy transition?
2. What are current enablers or potential enablers/solutions that can address these barriers?
3. How do barriers and solutions vary for different types of disability?
4. What co-benefits are Disabled people likely to experience in the energy transition? How do co-benefits vary for different types of disability?

Defining disability and 'energy and disability'

The literature review was informed by what is automatically considered a disability by law¹. The law says someone is Disabled if both of these apply:

- They have a 'physical or mental impairment.'
- The impairment 'has a substantial and long-term adverse effect on their ability to carry out normal day-to-day activities'.

People with these conditions and impairments are automatically protected under disability discrimination law:

- Cancer.
- An HIV infection.
- Multiple sclerosis (MS).
- A visual impairment.
- Severe disfigurement included on this list under the Equalities Act.

Progressive conditions

A progressive condition gets worse over time e.g. Alzheimer's disease, motor neurone disease, muscular dystrophy and Parkinson's. Someone with a progressive condition is considered by law to have a disability as soon as it starts to influence their normal day-to-day activities, if this is likely to be long-term. The effect does not have to be substantial. Long term means for at least 12 months or for the rest of life.

¹ <https://www.acas.org.uk/what-disability-means-by-law>

Impairments or health conditions to consider in the literature review

- Visual impairment.
- Hearing impairment.
- Speech impairment.
- Physical impairment, restricted mobility.
- Mental health condition.
- Neurodivergence including ADHD, autism, dyslexia and dyspraxia.
- Learning difficulties and disabilities.
- Long term health conditions. Not exhaustive but includes: cancer, MS, HIV, progressive conditions including Alzheimer's disease, motor neurone disease, muscular dystrophy and Parkinson's, long COVID.

What is being considered within 'Energy and Disability' and the 'Energy transition'?

- Heat networks – building works, uptake, cost, other (quality of heat supply?)
- Retrofit – assessment, coordination, installation and post installation advice. Retrofit process support.
- Energy advice – behavioural, fuel bills and tariffs, metering, dealing with energy suppliers, energy efficiency improvements (small, large), low carbon technologies, grants. Appropriateness and uptake of smart devices related to energy use e.g. heating controls.

Search terms

Primary Search Terms	Secondary Search Terms
Disability AND energy	Visual impairment; blind, partially sighted.
Disability AND decarbonisation	Hearing impairment; deaf
Disability AND energy justice	Speech impairment
Disability AND energy transition	Physical disability
Disability AND energy advice	Restricted mobility
Disability AND retrofit	Mental health condition; mental illness
Disability AND energy efficiency OR home improvement	Neurodivergent, ADHD, autism, dyslexia, dyspraxia
Disability AND fuel poverty	Cancer, MS, HIV, dementia, Alzheimer's disease, motor neurone disease, muscular dystrophy, Parkinson's. Other progressive conditions.
Disability AND net zero	Learning difficulty, learning disability
Energy vulnerability AND net zero	
Disability AND heat network	Health condition
Equity AND low-carbon transitions	Impairment

Primary Search Terms	Secondary Search Terms
Vulnerable OR vulnerable consumer AND energy	
Disability AND insulation	
Disability AND heat pump	
Disability AND low carbon technology	
Disability AND smart	
Dependent on electricity AND energy	

Search parameters

Type of literature searched for and included

- Known researchers and disability organisations.
- Existing disability-related references from fuel poverty and energy transition literature review.
- Google search, Google scholar.
- Peer-reviewed journals.
- Government and other organisation reports and policy documents (e.g. energy and EDI).

The identified literature was scanned to ensure relevant evidence was included based on the following criteria:

- UK references, or European studies with significant input about a UK location.
- Published 2015-2024.
- Responds to at least one of the research questions.

In total, 59 literature sources were collated.

Analysis

The long list of 59 literature sources was shortlisted based on the number of research questions that the reference responded to, and the topics covered (e.g. advice and information, retrofit, electric vehicles). Twenty-three pieces of literature were read in detail. Each piece of literature was assessed using a Red-Amber-Green (RAG) rating system for both quality and comprehensiveness relevant to the research questions.

- High quality = Peer reviewed journal, report from reputable organisation. (All short-listed references were high quality).
- High detail – gives a comprehensive response to two or more of the research questions.
- Medium detail - comprehensive response to one research question.

- Low detail - addresses one research question but not comprehensively.

The RAG assessment was completed after reviewing the shortlisted documents, based on the reference's response to at least one research question.

- Green = high quality and detail.
- Amber = high quality, medium detail.
- Red = high quality, low detail.

In total, the 23 shortlisted references were assessed as 14 green, three amber and six red. The red, low detail references tended to discuss impairment and health condition within a broader framework of vulnerability or fuel poverty. Assessment of references based on their response to the research questions is summarised in Table 1. Very few references were found for research questions 3 and 4.

Table 1: RAG assessment for shortlisted references by research question

Research question	High detail	Medium detail	Low detail
1. What are the barriers that Disabled people experience (or anticipate experiencing) in the energy transition?	14	3	6
2. What are current enablers or potential enablers/solutions that can address these barriers?	13	2	5
3. How do barriers and solutions vary for different types of disability?	3	1	
4. What co-benefits are Disabled people likely to experience in the energy transition? How do co-benefits vary for different types of disability?	1		

A summary of key points from shortlisted references in response to the research questions was drafted under three topics of investigation: energy information and advice, retrofit, and electric vehicles. Areas with little or no references were noted, such as heat networks. Overall, the number of relevant references for energy and disability was low.

Appendix 2: Literature review, summary of barriers and solutions for other themes

Detailed below are the various barriers, and possible solutions, that Disabled people may experience in the energy transition.

1. Financial

Barriers

Disabled people:

- Tend to be on low incomes. Unpaid caregivers have limited time for paid work.
- Might find it hard to maintain employment.
- Cannot afford appliances or retrofit if on a low income.
- Are less likely to have a financial 'buffer' for unexpected purchases or increased living costs.
- Are less likely to have capital to invest in smart and low carbon technologies.
- Find extra running and maintenance costs of renewable technologies unaffordable.

Solutions

- Funding options for those that are asset rich/cash poor (e.g. some older people) and that help Disabled people to make medium term investments.
- Repayment plans (e.g. for incomeed families to spread cost of home improvements).
- Means-tested subsidies for price protection.
- Funding for additional support needs e.g. loft clearance.
- Funding should be adaptive so that measures can be implemented in ways that are suitable for the household.
- Social tariffs (cheaper tariff for those on low income).
- Improve access for Disabled people to private cars (or alternative, accessible modes of transport).

2. Energy information and advice

Barriers

- Information is not accessible e.g. websites.
- Too much information is confusing.
- Information has a lot of technical jargon.
- Lack of information and low awareness about energy efficiency and Smart Export Guarantee tariffs (to reduce costs or optimise use of renewable technologies).

- Lack of information on certified installers.
- Conflicting, confusing information or advice from professionals (health, social care, housing). For parents, it's difficult to know which measure to adopt in the context of a child health condition.
- Disabled people can feel stigmatised, excluded and disengaged when information and advice is not applicable to them.
- A Disabled person might have an inability to concentrate and take in information due to mental health condition, learning disability or neurodivergence.
- Advice from professionals can be inaccessible e.g. advisor speaking too fast; long call wait time to suppliers.
- Isolation contributes to lack of access to services.

Solutions

- Involve Disabled people in the design of engagement campaigns. Many want to reduce their carbon footprint.
- Make reliable and simple information accessible through appropriate channels of communication (e.g. video, websites).
- Tailored information and support to enable Disabled people to make suitable low-carbon energy choices.
- Helpline and clear referral pathways for energy advice.
- Integrate energy advice with health, advocacy, and financial support to increase overall personal wellbeing.
- Create an electricity pricing notification system (text or app), so people can make better tariff choices.
- Provide better information about running costs of MDE technologies.
- Provide information to friends and family (e.g. caregivers) as they are trusted for advice. Enable peer support.
- Energy suppliers provide accessible co-ordinated information and support:
 - Easy read information and energy bills.
 - Improved telephone customer services (e.g., avoiding call holds, advice lines with no time pressure, call-back systems, training for advice line staff about effective communication with people with learning disabilities).
 - Ensure support workers, advocates and family members are linked into relevant communication and information.

3. Smart meters

Barriers

- Cost of energy may deter adoption of smart meter (if have high energy use due to health needs).
- Unsure of role and action of smart meter, especially if smart prepayment meter.
- Unsure about use of In-Home Display to monitor energy.

- Display unsuitable for people with visual impairments.
- Meter location can limit ability to monitor energy use.

Solutions

- In-Home Display to have larger font and buttons, simpler phrasing, audio instructions and a colour display.
- Provide information on function of smart meter and use of display and online account to monitor and reduce energy use.

4. Health and High energy use

Barriers

- People with physical impairments are prone to fuel poverty, especially those with medical dependency on electricity, low income, and the terminally ill.
- Mental health issues can diminish uptake of energy advice and retrofit support, sometimes exacerbating health issues.
- Medical dependence on electricity or need for routine may restrict a Disabled person's ability to participate in flexibility services or fully benefit from time of use tariffs. This can lead to increased fuel bills.
- Power cuts may have significant impact, addressed by the DNO Priority Services Register.

Solutions

- Provide battery storage to those medically dependent on electricity on the PSR in areas prone to power cuts. Similarly, offer battery powered heating or off-peak heat storage to support the heating needs of Disabled people during an outage.
- Link DNO PSR services and NHS medical notes (with patient consent) to refer anyone medically dependent on electricity to the PSR.
- Warm Homes on Prescription - a new service where GPs can prescribe people that medically require a warmer home to have their heating bills paid.

5. Energy efficiency schemes

Barriers

- Complexity of government financial support.
- ECO scheme is not proactively targeted at Disabled people.
- Scheme eligibility criteria exclude Disabled people. Health issues are included, but disability benefits are not. The lack of state recognition of disability can lead to financial disadvantage (and exacerbate ill health) which could prevent retrofit occurring.
- Disruption during install, health and safety concerns.

- Possible damage done during installation.
- Poor quality work.
- If Disabled peoples' needs are not met (e.g. notice for appointments, face to face or non-digital advice, tailored implementation), they may drop out or not take up scheme support.

Solutions

- Change eligibility criteria of schemes to include caregivers allowance and disability benefits.
- Target communication of energy efficiency schemes to Disabled people.
- One stop shop where single agency offers advice and installation work providing seamless support.
- Single point of contact to build continuity/trust.
- Home visits considered essential to support uptake.
- Clear tailored plan of action agreed with the household in advance, which identifies any additional support needs (e.g. moving furniture), what to expect, timing and duration of works.
- Installer training to understand needs of Disabled people, appropriate behaviour and communication.
- Involve trusted intermediaries (e.g. DPOs, caregivers), with appropriate remuneration, with scheme information to promote take up and ongoing support.
- Monitor impact of schemes to build trust in them. Focus on social impacts as well as cost and carbon impacts.
- Disabled people needed to know their rights around questioning installers and the complaints process.

6. Product accessibility and compatibility

Barriers

- Appliances and technologies not accessible e.g. EV chargers and chargepoints. Suitably adapted technology may not be available for people with certain impairments (e.g. vision, hearing or dexterity impairments).
- Poor quality of products e.g. no lights to guide plugging in on EV charger.
- Devices not compatible with assistive technologies.
- Installation does not account for Disabled peoples' additional needs e.g. placement or height of charger can be determined by installer rather than the access needs of a Disabled person.
- Regular digital updates make it hard to keep up with technologies without good instruction.
- For Wheelchair Accessible Vehicles (WAV) the main concerns were:
 - Range of vehicle before it needs to be recharged.
 - Fear of not being able to independently drive and charge an electric vehicle.
 - No available space at home for a home charging unit.

Solutions

- Inclusive user-centred co-design for product and service development. Create products that are accessible, high quality, with suitable maintenance support.

- Improve the regulation and energy efficiency of MDE technologies.
- Greater collaboration between appliance manufacturers and disability stakeholders. Affordability, availability, and quality are key constraints in enhancing access to both electrical appliances and assistive products.
- Information on the accessibility of smart energy offers.
- Ability to try products first to check if it works with assistive technologies and can be used independently.
- Personalised information and installation support on smart home technologies (as for retrofit).
- Simple user interfaces, automating where appropriate to minimise user involvement with more complex processes.
- Provide options to adapt interaction with devices e.g. increasing font sizes, using voice commands.

7. Electric Vehicles

Barriers

- Different barriers experienced for different impairments (e.g. physical, sensory and/or cognitive) including dexterity, strength, access and comprehension.
- Weight of chargepoint cables is the biggest barrier. Cable management systems, length of cable, ease of holding, moving and positioning cable are also important.
- For wheelchair users or those who cannot bend down, the height and visual interface of screens can be an issue.
- For those who use wheelchairs or mobility aids, kerb drops or lack of a level access point can be problematic.

Solutions

- Accessible charging equipment and chargepoints.
- Remote charging via app that works with assistive technology.
- Checklist of questions to ask charger installers.
- In person charger pre-installation visit for siting, check on electric connections, assess current and future Disabled person's needs.
- For public chargepoints, install cable management systems that Disabled people with strength and dexterity impairments can easily use (e.g. lighter weight of cable).
- Have screen tilt positions for seated or standing users.

8. Attitudes and perceptions

Barriers

- Distrust of installers and energy system; fear of scams.
- Energy suppliers show little sensitivity to individual circumstances (e.g. blind person being asked to read the meter). This can lead to Disabled people being anxious at the start of a call, leading to heated discussions and lack of resolution of the energy issue.

- Interactions with suppliers can be tiring.
- Lack of confidence in using technology and technical processes associated with energy use and payment, including smart meters, thermostats, direct debits and prepayment meters. Fear of failure associated with trying new technology.
- Stigma of asking for help
- Fear of loss of control of heating, or discontinuity of supply
- Preference for familiar routines that work for person's impairment. Experience anxiety about changes in routines.

Solutions

- Ofgem stronger enforcement of energy suppliers re. Vulnerability Strategy. Better customer service and good practice.
- Improve energy industry knowledge of needs of Disabled customers via consultation with DPOs.

9. Personal and household characteristics

Barriers

Digital exclusion:

Predominantly affects older people, 35–44-year-old group and rural areas. It is due to either lack of digital infrastructure (e.g. poor connectivity, IT) or someone being unwilling to use IT or smart home technology due to lacking confidence in digital skills.

Tenure:

Disabled people are more likely to be social housing tenants or private renters than average. This means they have less control over space in the home or may not have space for technologies e.g. no room on flats. As tenants, they have little control of what technologies (and metering) can be installed. They are less likely to have off street parking for EVs.

Poor tenancy relations (e.g. landlord refusal) can block making home energy efficiency improvements.

Solutions

Provide digital inclusion support.

How do barriers and solutions vary for different types of impairment or health condition?

The literature review found few references on energy in relation to specific impairments or health conditions. When references were found, some could be generalised to other impairments or health conditions. For example, some people with sickle cell disease need a higher home temperature; otherwise, severe pain and hospitalisation can result. This impacts the person's ability to work. Similarly, people with mobility issues, Raynaud's Disease, cardiovascular and

respiratory conditions need a higher home temperature. Similarly, information in plain English and small chunks would aid learning for people with mental health problems or who are neurodivergent (or anyone with a limited ability to concentrate).

For people that use mobility scooters, these aids are the costliest equipment for electricity charging². If mobility scooter chargers had a timer or delay, this would avoid the Disabled person needing to go out to start the charging manually (possibly having to go outside at night). This could also make time of use tariffs a better option.

From a different energy angle, it is clear that further research is needed to explore how to make assistive technologies more sustainable whilst retaining their full functionality. An example could be exploring the potential for replacing the zinc-air batteries used in hearing aids, with rechargeable batteries.

Gaps and opportunities identified by the literature review

Firstly, no explicit reference was found in the literature review to research question 4, **What co-benefits are Disabled people likely to experience in the energy transition? How do co-benefits vary for different types of disability?** This area could warrant further research.

Secondly, no literature was found on heat networks and impairments or health conditions. In Bristol there have been significant road works when installing large underground pipes for heat networks. No references were found in the literature review on how such building works impact Disabled people or how Disabled peoples' needs are considered when planning this work. The Heat Trust, the independent not-for-profit consumer champion for heat networks in Britain, has guidance³ for registered heat network providers on how to communicate and interact with vulnerable consumers, which may include some Disabled people.

² Energy Systems Catapult (2023) Discovering disabled consumers' future energy needs: <https://es.catapult.org.uk/insight/discovering-disabled-consumers-future-energy-needs-rowanne-fleck/>

³ Heat Trust (2024) Identifying and communicating with Heat Customers in Vulnerable Situations

Appendix 3: Disabled people and caregiver survey respondent characteristics

70 Disabled people and caregivers that responded to the survey had the following characteristics. Number of responses to each question is given in brackets (n=).

Criterion		Count	% of total
Stage of retrofit (n=70)	No retrofit in last 3 years (2022-2024)	38	55%
	Retrofit in progress	8	11%
	Completed retrofit	24	34%
Age (n=65)	20-24	1	2%
	25-34	4	6%
	35-44	7	11%
	45-54	10	15%
	55-64	14	22%
	65-74	16	25%
	75 or over	13	20%
Gender (n=59)	Male	20	40%
	Female	37	57%
	Prefer not to say	2	3%
Ethnicity (n=65)	Asian / Asian British	4	6%
	Black / Black British	6	10%
	White British	44	68%
	Irish	1	2%
	Any other White background	2	3%
	Other ethnic group	4	6%
	Do not wish to disclose my ethnicity	4	6%
Tenure (n=65)	Owner occupier	42	65%
	Private renting	11	17%
	Social housing - renting	9	14%
	Social housing – shared ownership	1	2%
	Other – emergency accommodation	1	2%
	Prefer not to say	1	2%
Employment (n=65)	Employed full time (work 35 hours or more a week)	4	6%
	Employed part time (work less than 35 hours per week)	5	8%
	Not employed, looking for work	3	5%
	Not employed, not looking for work	9	14%

	Self-employed	3	5%
	Disabled unable to work	8	12%
	Retired	25	38%
	Full time caregiver	4	6%
	Volunteer	1	2%
	Student	1	2%
	Prefer not to say	2	3%
Location (n=65)	Inner city	11	17%
	Town	18	28%
	Suburb	10	15%
	Village	24	37%
	Countryside	2	3%
Occupancy (n=58)	Households with children (aged 17 and below)	19	33%
	Households with adults aged 18 to 64	15	26%
	Households only with adults aged 65 or over	16	28%
	Households with adults aged 18 to 64 and 65 or over	8	13%

Appendix 4: Disabled people and caregiver interviewee characteristics

Nine disabled people and caregivers interviewed had the following personal and household characteristics:

Criterion		Count
Stage of retrofit	No retrofit, none planned	1
	No retrofit, some planned	2
	Retrofit in progress	1
	Completed retrofit	5
Age	35-44	1
	45-54	2
	55-64	2
	65-74	2
	75 or over	2
Gender	Male	5
	Female	4
Ethnicity	Asian / Asian British	2
	Irish	1
	White British	6
Tenure	Owner occupier	6
	Private rental	2
	Other	1
Employment	Employed full time (work 35 hours or more a week)	1
	Employed part time (work less than 35 hours per week)	1
	Not employed, looking for work	1
	Disabled recovering from surgery	1
	Retired	3
	Volunteer	1
	Full time caregiver	1
Location	Inner city	1
	Town	2
	Suburb	1
	Village	4
	Countryside	1