

Greenhouse gas removals

Chapter 9



Summary of recommendations

- 1 Assembly members suggested that a **combination of greenhouse gas removal methods will be needed** to achieve the UK's net zero target.
- 2 Clear majorities of assembly members 'strongly agreed' or 'agreed' that **four greenhouse gas removal methods should be part of how the UK gets to net zero**:
 - **Forests and better forest management** (99%);
 - **Restoring and managing peatlands and wetlands** (85%);
 - **Using wood in construction** (82%);
 - **Enhancing the storage of carbon in the soil** (62%).
- 3 Assembly members saw these methods as the most "**natural**" and as **having significant co-benefits**, including around preventing flooding and erosion, and promoting biodiversity, access to nature and enjoyment. Assembly members also set out a number of conditions around their implementation, including that it was planned and managed well (for example, planting the right trees in the right places), support for farmers, sustainability, and ensuring a balance of land use.

- 4 Assembly members were **less supportive of Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Carbon Capture and Storage (DACCS)**. Only 42% of assembly members 'strongly agreed' or 'agreed' that each of these methods should be part of how the UK gets to net zero, while 36% (BECCS) and 39% (DACCS) 'strongly disagreed' or 'disagreed'.

Common concerns about BECCS and DACCS included the potential for **leaks from carbon storage sites** and a feeling that they **failed to address the problem**, including a risk that they are "treated as [a] magic solution" that "takes the focus off the amount that we are emitting in the first place." Assembly members also saw these methods, particularly DACCS, as being **less natural, costly** and **unproven** in terms of the technology they require.

- 5 **Whilst BECCS and DACCS received limited support, some assembly members were keen that further research and development took place**, noting for example that these technologies could perhaps then be used more in the future or that they might be needed to "mop up" remaining CO₂.

Greenhouse gas removals

Achieving the UK's net zero climate change target by 2050 necessitates reducing greenhouse gas emissions as much as possible. However reducing emissions alone will not be enough.

By the middle of this century some emissions will still remain. For the themes considered by Climate Assembly UK, this is particularly true of air travel and farming. The assembly's recommendations in these areas suggest remaining CO₂ emissions by 2050 of between 45–55 million tonnes per year. That compares to emissions of 366 million tonnes in 2018.¹

At the penultimate assembly weekend, assembly members considered how best to remove these remaining emissions from the atmosphere.

What did the assembly consider?

All assembly members heard evidence, deliberated and voted on the question of how best to remove greenhouse gases from the atmosphere. They heard about six potential removal methods:²

1. Forests and better forest management
2. Restoring and managing peatlands and wetlands
3. Enhancing the storage of carbon in the soil
4. Using wood in construction
5. Bioenergy with Carbon Capture and Storage (BECCS)
6. Direct Air Carbon Capture and Storage

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863325/2018-final-emissions-statistics-summary.pdf

² The Expert Leads explained to assembly members that there are other methods of removing carbon dioxide from the atmosphere. These additional methods are currently more speculative; more work needs to be done to enable them to be used at scale and to ensure that the risks associated with them can be managed properly.

The evidence session covered what these methods are and different views on their desirability. Assembly members had the opportunity to question each speaker³ in detail.

After the evidence session, assembly members discussed the six methods. They then voted on them by secret ballot.

What's included in this chapter?

Assembly members had less time overall to discuss 'removing greenhouse gases from the atmosphere' than they had for the themes covered in previous chapters, with the exception of 'where our electricity comes from'. They therefore focussed on just one question: which of six greenhouse gas removal methods should be part of how the UK gets to net zero.

This chapter presents their views in the following order:

- A. **Vote results:** the assembly's final recommendations on which of the six greenhouse gas removal methods should be part of how the UK gets to net zero;
- B. **Rationale and conditions:** assembly members' rationale for their votes, as well as areas they would like to see considered around the implementation of each of the six methods;
- C. **Cross-cutting considerations:** points emphasised by assembly members when looking back across all six options at the end of their discussions.

The chapter ends by summarising the conclusions from across these sections.

Contents of this chapter

A. Votes results	page 426
B. Rationale and conditions	page 429
Forests and better forest management	page 430
Restoring and managing peatlands and wetlands	page 438
Enhancing the storage of carbon in the soil	page 445
Using wood in construction	page 452
Bioenergy with Carbon Capture and Storage (BECCS)	page 462
Direct Air Carbon Capture and Storage (DACCS)	page 470
C. Cross-cutting considerations	page 479
Conclusions	page 481

³ The assembly heard from three speakers on removing greenhouse gases from the atmosphere: Chris Stark, Committee on Climate Change (informant); Bill Spence, independent (advocate); Dr Douglas Parr, Greenpeace (advocate). All speakers' presentations are available as slides, videos and transcripts at climateassembly.uk/resources/. An 'informant' is a speaker who we asked to cover the range of views and available evidence on a topic. An 'advocate' is a speaker who we asked to give their own view, or the view of their organisation. Assembly members knew whether speakers were informants or advocates.

A. Vote results

Assembly members voted on ways of removing greenhouse gases from the atmosphere by secret ballot. There were two different ballot papers. The first ballot paper asked assembly members how much they agreed or disagreed that each method should be part of how the UK gets to net zero. The second ballot paper asked them to rank the methods in their order of preference.

The votes from this second ballot paper were counted in two ways:

- **Counting assembly members' first preference votes only.**
- **Using Borda count.** This involves allocating points for preferences – a first preference vote scored five points, a second preference vote four points and so on. A sixth preference vote scored no points. Counting the votes like this tells us which methods are most acceptable to the greatest number of assembly members. This is particularly useful for this question, where it is likely that more than one way of removing greenhouse gases from the atmosphere will be needed.

More than 50% of assembly members 'agreed' or 'strongly agreed' that four of the methods should be part of how the UK gets to net zero. These were **forests and better forest management (99%)**, **restoring and managing peatlands and wetlands (85%)**, **using wood in construction (82%)** and **enhancing the storage of carbon in the soil (62%)**.

Of these four methods, assembly members were:

- Most supportive of forests and better forest management, with 81% 'strongly agreeing' with its use and no assembly members 'disagreeing' or 'strongly disagreeing';
- Least sure about enhancing the storage of carbon in the soil. A number of assembly members raised concerns that they didn't fully understand how this option worked. This could have increased the number of assembly members saying they were unsure. Assembly members also noted points that this disliked about this option (see Section B).

In comparison to the first four methods, **BECCS** and **DACCS** saw much lower levels of agreement – 42% each. They also saw higher levels of disagreement, with 36% (BECCS) and 39% (DACCS) of assembly members 'disagreeing' or 'strongly disagreeing' that they should be part of the path to net zero.

Figure 1
How much do you agree or disagree that each of the following greenhouse gas removal methods should be part of how the UK gets to net zero? (% votes)

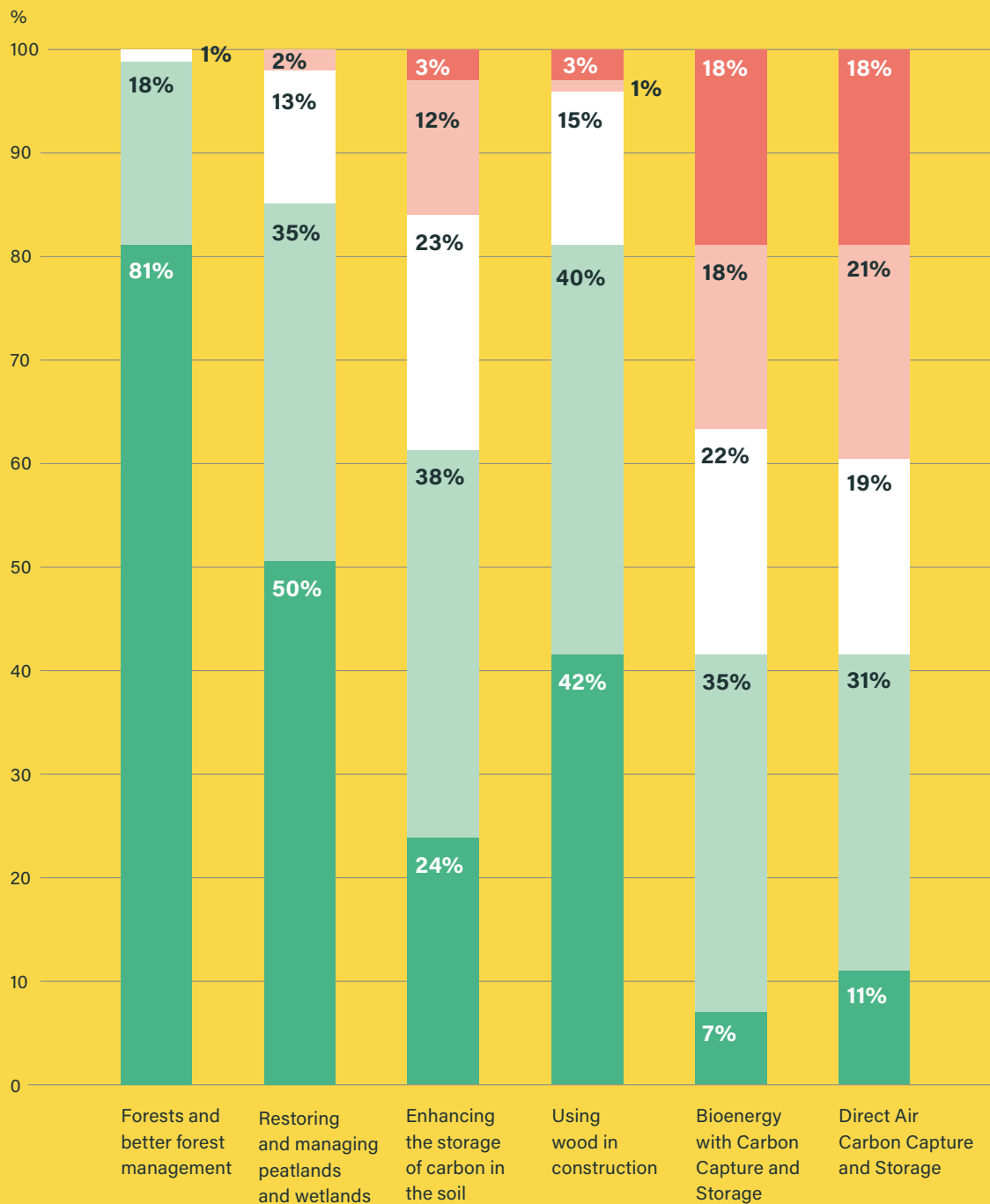
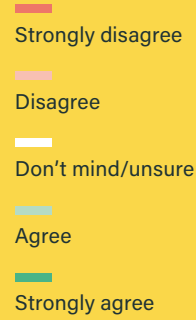


Figure 2

Please rank the following greenhouse gas removal methods in your order of preference (% first preference votes)

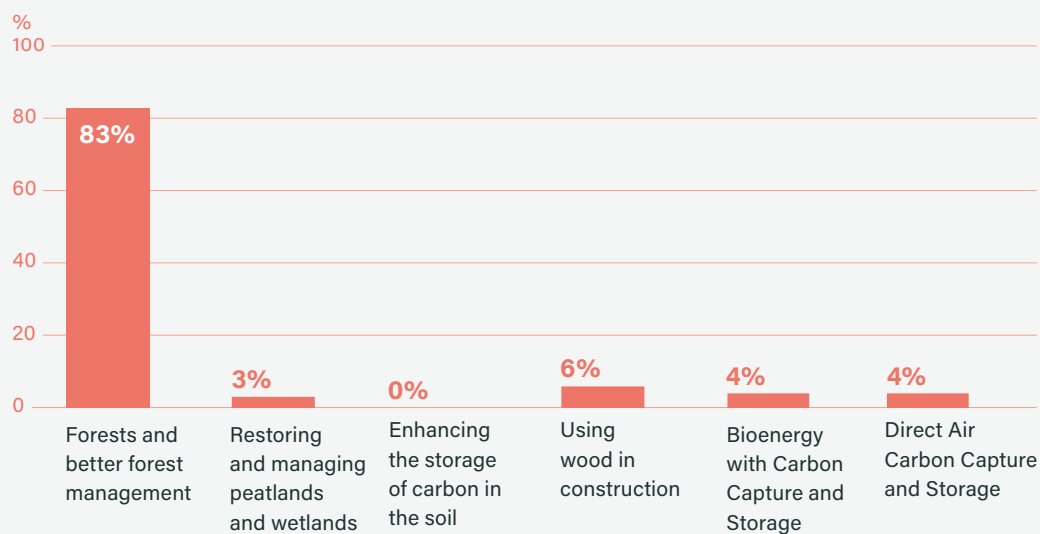
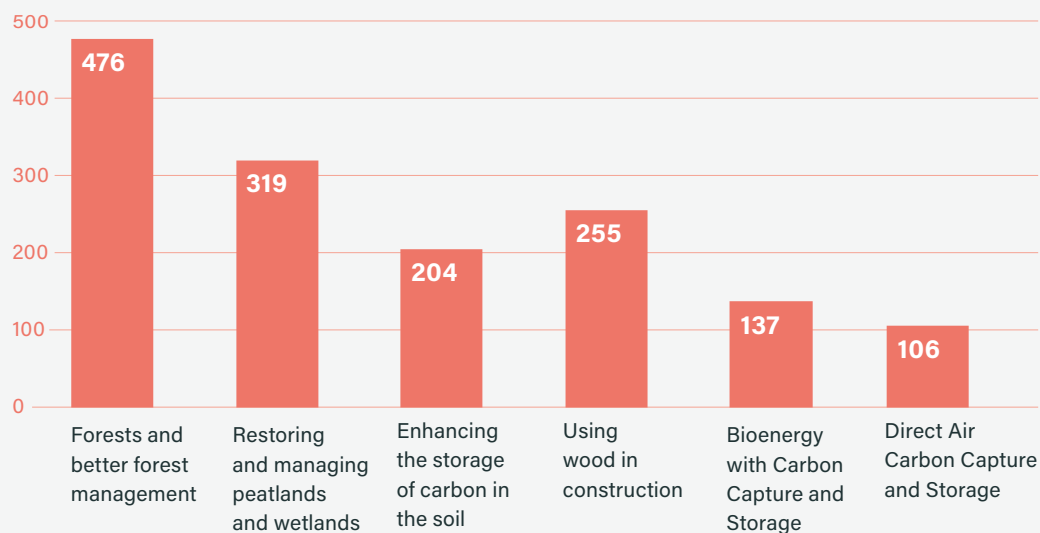


Figure 3

Please rank the following greenhouse gas removal methods in your order of preference (% first preference votes)



Assembly members' ranking of the methods painted a similar picture. **Forests and better forest management** remained assembly members' preferred option, receiving 83% of first preference votes. It was again followed by **restoring and managing peatlands and wetlands**, **using wood in construction**, and **enhancing the storage of carbon in the soil**, in that order.

As with the first vote, **BECCS** and **DACCS** scored less well, with the former scoring slightly higher than the latter.

Some assembly members commented that they would have liked more information about all six methods, expressing "a desire to be able to quantify things either by land area or investment cost needed to achieve the removal of one tonne of CO₂".⁴ Some also commented in relation to DACCS that they didn't "see how we can make a decision on it, when so little is known."

B. Rationale and conditions

This section contains:

- The reasons that sit behind assembly members' votes, as just reported;
- 'Conditions' that some assembly members felt would support the use of each method or that they suggested should be in place for it to be used.

Given the detailed nature of assembly members' comments, we have categorised the pros and cons for each of way removing greenhouse gases from the atmosphere under six headings:

- Environment impact and land use;
- Practicality, efficiency, readiness and scale;
- Costs, the economy and jobs;
- Public support;
- Safety and risk;
- Other.

The category titles are our words, not assembly members', and are just there to make assembly members' thoughts easier to navigate. All the content under the headings is however assembly members' own.

We have kept in contradictory opinions in order to show the full range of views amongst assembly members. The results of the votes above tell you what conclusions assembly members reached having considered all these points, and the weight of feeling in support (or not) of each way of removing greenhouse gases from the atmosphere.

⁴ Assembly members heard evidence about the relative cost of the different methods. It was not possible to give them the more precise figures requested because there are a range of plausible costs for direct CO₂ removal methods. Methods also carry a variety of wider costs and benefits that hinder simple cost comparisons.

B.1 Forests and better forest management

Forests and better forest management refers to planting and managing forests. These absorb carbon dioxide, a greenhouse gas. Assembly members discussed this option in small groups, noting pros and cons.

⊕ Pros

Assembly members identified the following areas as points that they liked about forests and better forest management.

⊕ Environment impact and land use

A large number of assembly members described forests and better forest management as “**natural**”, “very natural”, “more natural”, “nature first”, “working with a natural way” or the “most natural way of solving the problem.” Some said “we would like to start with natural processes”, that “[we are] all for nature based approaches” or that it’s the “best solution as [it is] given by nature.” Others commented that the “problem is a man-made one, [it] should have natural solutions” or that we “will need some man made interventions but more natural is better.” Some felt that “all of the nature ones [greenhouse gas removal methods] made sense to do all together” or that it’s “naturally there, there’s already forests growing so to continue this makes sense.” Some assembly members commented that we are “seeing with covid-19 that nature is coming back when humans step back ... skies are clearer and birds are singing and maybe it’s a wakeup call.” Others said a “more holistic approach [is] needed to help the planet heal – forests are part of the ecosystem and we are integrated with that too.”

Another large number of assembly members suggested that this greenhouse gas removal method would have “**multiple benefits**” “other benefits”, or that there’s a “double benefit of bringing in more forests”. Almost all these assembly members said their comments related to one or more of the points covered in the rest of this subsection.

Some assembly members suggested forests and better forest management are “good for wildlife”, “encourage wildlife”, would bring “increased **biodiversity**”, or that “when well located [forests] can have additional biodiversity benefits.” Similar points included that they provide “natural habitat for a lot of animals”, “enhance habitats for biodiversity” or that a forest “takes 10 years to grow, 100 years to [reach] maturity so [you] get 90 years of them taking in carbon and in that 90 years it’s offering habitat for animals.” Other assembly members commented that “humans have damaged the environment significantly, we need to restore natural habits whilst helping the environment.” Some felt it would be “good for native trees” or “improves nature.”

Some assembly members made more general points, saying forests and better forest management have “**good overall environmental impacts**” or that they would be good for the “ecosystem.” Others said we “can integrate animals in [the] forest (for agriculture) and provide a mixed and balanced ecosystem” or that they wanted to “restore natural forests.”

For some assembly members it was important that forests “help reduce flooding”, provide “**flood protection**”, or are a “flood defence.” Others noted they “potentially [have]...knock on effects re flood management.” Some said they “provide shading” or “provide **shelter in hot climates.**”

Some assembly members talked about a “**mental health**/wellbeing value – people can clear their heads when they walk through a forest.” Some commented that it’s “nicer to live in an area with trees”, that they would be “happy to have forests next to me” or that they “like it on face value, I like the countryside, nature and going for walks.” Others talked about “**enjoyment**, joy from forests” or said “at least no one will be offended by it.” Some suggested that “reforestation can increase local amenity e.g. nature walks etc.”

Some assembly members suggested that “once planted [a forest] doesn’t take any energy”, that it “doesn’t use electricity” or that it has a “**smaller carbon footprint** to implement than building CCS technology.” Some said it is a “**good use of land** that appears to have significant carbon capture impacts per area of land compared to other natural options.”

⊕ **Practicality, efficiency, readiness and scale**

Some assembly members felt that forests and better forest management **combine well with other greenhouse gas removal methods**. Some assembly members suggested they “could be used as part of a natural cycle, in combination with building materials or bioenergy”, or similarly that “trees, when they have reached their useful carbon capture life can be used for biofuels or for building (dual benefits).”

Some assembly members made similar points or talked about other ways forests and better forest management could be used:

- + **Construction and manufacture** – some said it could be used to “supply wood to use in construction”, or that the wood could be “used for housing or furniture.” Others said “we shouldn’t just look at buildings for construction, what about wooden street signs etc”;
- + **Education** – some noted the “need to cut down and replenish [forests]” and suggested that this could be linked to “school initiatives: extracurricular activities – would be great to see more of it here in the UK – [there is an] example in Poland”;
- + **BECCS** – some suggested that “material cleared during forest management can be used for biofuels (without growing crops specifically for this)” or that “this option is not isolated from the other land-use options, they’re linked, e.g. management of forests can be used to generate biomass.”

For some assembly members forests and better forest management are a “good option for the UK – we have a lot of **space** for forests and tree planting....” Others felt “we have the space to do it particularly in [the] north of England and Scotland”, that “small farms could be used for planting” or that we “can make better use of land.” Some said “only 5% of land is needed to do enough of this – that’s not a lot.”

A number of assembly members felt it would be “**easy** to do”, the “easiest to execute” or suggested that it can be “**easily multiplied** and repeated around the country”, with others labelling it “achievable.”

Some liked that it “**doesn’t rely on new technology**”, “doesn’t need too much technology” or “avoids emphasis on tech answers which may be being pushed more than appropriate to keep ‘big boys’ in jobs.”

A number of assembly members noted that “we know it works” or that “trees are good at removing CO₂ – it’s a **proven method**.” Others suggested that it is **efficient**, saying it “stores lots of carbon.” Some assembly members said “it **takes the CO₂ out straight away**” or that we “can achieve [it] quickly.” Others disagreed, saying “it’s obviously important [and] worthwhile but [it’s] a long-term solution.”

+ Costs, the economy and jobs

Some assembly members said forests and better forest management would be “**low cost**”, “cheapest”, “**cost effective**” or that they “could be upscaled relatively cheaply and quickly.” One said they’re “low cost, and will make an impact so [we] might as well.” Another suggested they’re “cheap and could be income generating.”

Some assembly members suggested forests “attract tourists (e.g. Lake District)”, or that they are “good for access for people – they can go and use the forest, means more leisure activities available, **good for [the] local economy**.” Others said it “makes money for the country”, or that “forestry can bring jobs as well.”

+ Public support

Some assembly members talked about the “aesthetics of forests” saying that “trees and forests are **beautiful**.” Others contrasted forests to the other options noting that “with bioenergy and CCS, it’s more infrastructure (i.e. ugly buildings).” Some said they “**like the idea** of new forests and trees where not planted before”, that we “wouldn’t exist without trees” or that they are a “fan of trees – suggest encouraging landowners to give over [a] % of their land to trees.”

One assembly member said it “brings people closer to nature.” Another commented that “where I am from, where my family is from, on the continent, tree planting has always been part of our daily lives – you put it in, you take it out – it’s a green option.”

+ Safety and risk

No assembly members made comments in this area.



+ Other

Some assembly members stated they are “all for it”, or that it’s “very important – it’s a major part of the solution i.e. whether that be in conjunction with BECCS or direct air capture for example.” Others said it’s a “win-win” with “a few niggles but overall a good idea.” Some commented that they were “not sure why it’s not at the top of the agenda, there’s literally **no bad point to it**”, or that “as long as [it’s] not impacting wildlife, what’s bad about planting more trees.”

Some assembly members expressed scepticism about suggested downsides, saying it’s “been mentioned that one of the cons is that this method takes up land that could be used for other uses such as crops, farming, but that’s not much of an argument especially when we’re encouraging people to eat less meat and have fewer cows in fields.” Others said it’s “better to do something rather than nothing, so [we] should pursue this.” Some assembly members said it “seems like **common sense**”, is a “no-brainer” or “should be happening irrespective of other solutions.”

A number of assembly members said they felt it was a “**global** solution – planting trees anywhere on the planet has benefits for all” or should be a “global effort not just the UK.” Some commented that “other areas in the world where we can plant trees could further increase the forest mass around the world.”

⊖ Cons

Assembly members identified the following areas as points that they disliked about forests and better forest management.

⊖ Environment impact and land use

A number of assembly members suggested forests and forest management **might not be that effective**. Some said we “mustn’t be naïve about how much carbon a tree can remove – it can only do so much” or it “doesn’t take all carbon dioxide out of the atmosphere.” Others noted it “takes 10 years for them to start absorbing CO₂ and the tree becomes less productive at 100 years.” Some questioned “how much difference will it really make?” or felt it **wouldn’t work long-term**, noting “presenters said trees store carbon for decades, but this is not a decade’s problem, it’s a longer problem.” Others suggested that “if the trees are cut down and burned this could have the reverse effect on CO₂ levels”, while some branded it “carbon ‘relocation’ rather than storage – the carbon will be released at some point...”

Some assembly members warned that we need to “be careful about [the] **impact on wildlife**” or the “impacts of non-native tree planting on **biodiversity**” including “for native trees.” Others said that the “10 year optimum turnaround for forest trees before harvesting” was a concern “because of habitat and biodiversity impacts.” Some suggested that there could “perhaps [be a] loss of biodiversity.”

One assembly member highlighted the potential “health impacts on people of non-native planting e.g. allergens.”

⊖ Practicality, efficiency, readiness and scale

Some assembly members asked “where are we going to get sufficient land from? ”, or commented “[I am] unsure whether we have enough **space** to accommodate new forest... So much green space and farmland is lost to roads and housing where I live.” Others questioned whether there was “enough available / suitable land for it to make a real difference in the UK (particularly in the south)”, saying we “are a small country” and “5% feels like a lot of land.” Others said it “won’t be the ‘one big solution’ – needs too much land.”

Relatedly, some assembly members worried about the “**impact on other land use**.” Some commented that “there need to be options other than using the land we need for growing food”, or that we “could use land for other uses e.g. crops or biofuels etc” or “wind”. Some assembly members asked “how scalable is it?” or suggested it has “**limited capacity**” because we can “only [have a] certain amount of trees.”

For some assembly members there were other questions around **feasibility**. They asked “who will be prepared to give up land?” and “who will pay for the land?”. Others said “there have been plans to plant more trees in the past and nothing has happened. Don’t want to put a lot of money into something that doesn’t end up happening.”

A number of assembly members said it “takes a long time for them [trees] to grow and [we] need to grow a lot of them.” Others said it “takes time before we see benefits” or we are “racing against the clock, so **need [a] more aggressive solution.**” Similarly, some assembly members commented that “trees take a long time to grow... [that means we] need something else as well – think need all the options to contribute.”

⊖ **Costs, the economy and jobs**

One assembly member asked “how much will it cost?”⁵

⊖ **Public support**

No assembly members made comments in this area.

⊖ **Safety and risk**

No assembly members made comments in this area.

➔ **Conditions**

Some assembly members noted conditions around the use forests and better forest management – points they felt would aid its implementation or that should be put in place. They suggested a need to:

➔ **Get the legislation right**

Assembly members made comments including:

“We were told the law surrounding protecting trees is really weak, which means any developer can cut down any amount of trees unless it’s a special tree, so we need stronger legislation that protects trees and forests to enable this approach to work.”

“Don’t know if there’s a regulatory body that has an overview of all the forests but need one to ensure things are done correctly.”

“There’s a clear role for government to make sure that whatever is decided about forests sticks.” It “needs to be set in law if it is to work.”

⁵ Assembly members heard evidence about the relative cost of the different methods. It was not possible to give them the more precise figures requested because there are a range of plausible costs for direct CO₂ removal methods. Methods also carry a variety of wider costs and benefits that hinder simple cost comparisons.

→ Plant the right trees, in the right places

Some assembly members said they were happy with this idea as long as it's the "right kind of trees in [the] right places." For some this meant "as long as there is biodiversity" or as long as "it enhance[s] local areas and biodiversity." Specific comments included:

- *"Difficult to convince people to not just plant miles of spruce as need a variety of hard and softwood trees – need natural biodiversity";*
- *"Need to plant the right type of trees – there was an issue in Scotland where they planted a lot of evergreen trees which made a very dark woodland and they ended up having to chop it down and replace with deciduous";*
- *"Best types of trees for carbon capture are the fast growing ones – but they are not always native. Important to not bring [in] non-native species."*
- Non-native trees can harm "both the visual [appeal]... of an area as well as local habitats";
- *"Must be done with consideration to the wildlife";*
- Some assembly members put forward a potential solution: "Local groups safeguarding specific forests encourages buy-in, makes sure things are done well and also focuses on protecting biodiversity rather than a large developer with an interest in just sequestering carbon alone. ... local groups would ... have a vested interest in the biodiversity of the area and help manage it better."

Others noted the need to think about what is planted where for other reasons:

"Mustn't impact on land use too much / need to find the right locations."

"It would be better to use less productive land, land that wouldn't be used for crops."

"Must be managed alongside farming."

Some said we should "grow fast-growing trees which are useful."

→ Plan properly and manage forests well

Related to the above some assembly members noted that "a proviso is tree planting can be done badly so need to have a plan to ensure it's done properly and work on tree management."

Specific comments from assembly members included:

- We need "careful management as concerned about the space";
- *"There needs to be management in the sense of risk of wildfires – sensible barriers in place to mitigate this";*
- "All these systems have to work together. If you have a forest, you need to manage it. Some of the wood could be useful for composting or biomass – all the systems have to gel, work together to be effective." Others suggested we "[u]se the trees for construction, but fell them in a good way that doesn't damage wildlife" or that it "needs more emphasis on using wood for house building." Others disagreed saying "[w]e should also protect trees more, ie not cut them down for buildings etc";

- “Better forest management [is] essential to knowing when and how to use trees (e.g. when to cut down).” It “needs to be done properly to be efficient” and we need to “make sure [we are] thinning trees effectively.”

② Think about what mature trees are used for

Some assembly members said that support was “conditional on what trees are used for when they reac[h] their carbon capture maturity” with some strongly opposing any use for bioenergy. Others felt we should “use the wood” and not “waste” it, with some suggesting we “use the wood for building so it doesn’t release the CO₂ so fast.”

② Combine it with other options

Some assembly members said it “needs to be done with other things”, that it’s a “brilliant thing to do but not enough on it’s own” and that it “isn’t enough on its own but is a starting point.”

Specific comments included:

- It “makes the most sense when combined with peatlands/wetlands and soil options as it allows land to be used to capture carbon in the best way in each place”;
- “It “should not be an either/or alternative” – we “need to consider a hybrid solution between the 6 options...”;
- “*Not as much of an impact as BECCS – can’t solve the issue on it’s own*”;
- We “may need to use other less natural models to address carbon levels in the short term – could revert to these more natural processes later down the line?”
- “Option a) is only my favourite if it [is] used to support options d) [using wood in construction] and e) [BECCS].”

② Win support, including through incentives

Some assembly members said this “needs the support of landowners”, while others suggested that “we need to entice anyone with any land, no matter how small, to plant trees.” Some assembly members asked: “Forests aren’t seen as progress, is that why it’s less appealing to policy-makers? This option needs to be packaged in a way that’s more positive.” One assembly member said it would be important to “make sure that farmers are not pushed out or demonised (can do this with grants for farmers).”

→ Protect jobs and incomes

Some assembly members said we need to assess the potential “job creation benefit... if forests are planted on former farmland, which may reduce jobs overall.” Others said that “farmers need compensation for lost income.”

→ Start now

Some assembly members suggested that we “need to start doing it now as [it] takes at least 10 years.” Others suggested that we could “start by not cutting down existing trees.”

Other assembly members asked whether “land-use [can] be combined, for example can trees be grown spread out over a large area of land?” and whether “hedgerows store carbon too?” Others suggested that this “needs to be co-ordinated nationally” and “must be combined with putting less emissions into the atmosphere.” Some assembly members mentioned a need to look at forests abroad too “e.g. deforestation in Brazil, not enough international pressure to stop that but that’s the only way for them to make money – need to support them in other ways.”

As seen in Section A, assembly members expressed very strong support for forests and better forest management in their votes.

B.2 Restoring and managing peatlands and wetlands

Restoring and managing peatlands and wetlands refers to restoring or managing some naturally wet areas of land so that they absorb more carbon dioxide. Assembly members discussed this option in small groups, noting pros and cons.

+ Pros

Assembly members identified the following areas as points that they liked about restoring and managing peatlands and wetlands.

⊕ Environment impact and land use

A significant number of assembly members said restoring and managing peatlands and wetlands would “protect against flooding”, “aids with **flood protection**”, “could help to prevent flooding if maintained correctly” or is a “flood defence.” Others said it “holds back water to stop flooding” or that it “will abate a lot of the flooding (of which there has been an increase over the last few years) and will stop this in high risk areas.” Some assembly members suggested **particular benefits for coastal areas**, suggesting that “when done in coastal areas [it] can help with flooding” or it’s “beneficial for coastal erosion and flood planes where it can be a more bog like environment.” Others suggested it would “ensur[e] land is not drained and sold for housing that would create flood risks elsewhere” or that “reducing flood risk / flood management needs” would have “additional economic benefits.”

Some assembly members described restoring and managing peatlands and wetlands as “**natural**”, “a natural solution”, or “part of the natural world.” Some said that they “like nature orientated solution[s]” or that they “trust it more than man-made solutions.” Others commented that “it’s not interfering, it’s more restoring things and removing existing management.” Some said “it speaks to restoring nature.”

A number of assembly members talked about the **importance of protecting and restoring peatlands and wetlands**. Some commented that “peatlands and wetlands have been there for thousands of years – we need to protect them” or that this is a “reason to protect and preserve current wetland areas that may be at threat.” Others suggested that “managing what we have is important” and that we “should be doing it anyway.” Some talked about a “need to stop current destruction of these areas” or said it was “not just a case of restoring wetlands but also keeping the ones that are still there. [...] Need legislation to protect the wetlands.”

Relatedly, some assembly members liked that it “look[s] after the countryside and wildlife”, or is “**good for wildlife**”, “good for birds”, or “**good for biodiversity**.” Some commented that “it maintains the wetlands for wildlife too”, or particularly noted benefits for “moss, frogspawn & heather.” Further comments included:

“They are beautiful, a source of nature and wildlife, birds fly in huge flocks, it’s beautiful.”

“Peatlands and wetlands have some of the ...[highest] levels of biodiversity in the UK so returning these spaces to nature – plants animal/insect species has importance for the wider ecosystem e.g. pollination.”

Some assembly members liked a “focus on restoration of peatlands and wetlands **to stop further release of CO₂**.” Others said that “peatlands and wetlands keep in CO₂ which is good. Some commented that there is “good **potential for CO₂ absorption**”, that it “captures CO₂” or “enhances storage.” Others said that they “like that it’s a carbon sink – holds carbon better than many other processes” or that it “locks up carbon unless it dries out / burns.”

One assembly member described it as “environmentally friendly.” Another said they “prefer forests or growing crops instead BUT disturbing the land is damaging.”



⊕ Practicality, efficiency, readiness and scale

Some assembly members noted that we “**have the knowledge and technology to do this**” or that we “know how to restore it – unlike man made solutions where we don’t know enough – there’s no risk.”

Some assembly members suggested that it is a “**good ide[a] where applicable**”:

“Every option should be used where it will offer the most benefit. For this one if it’s there then yes, retain it and keep it. It’s not applicable to everywhere.”

Others said it has “strong potential as part of a mixed approach”, “should be a part of our plans” or that it’s “for a local level rather than at national level – it can only work where they are situated.” One assembly member said it “can be used inland as well as [in] coastal [areas].”

Some assembly members commented that we “can start this fast”, that it “seems to be the quickest method that will have an impact” or that it’s “a **quick solution**, unlike some other measures.”

+ Costs, the economy and jobs

Some assembly members felt it would be “good for [the] local economy” or that “there will be jobs in managing these areas.”

Some suggested it would be “low cost”, “not high cost” or a “cheap way to store carbon.”

Others said that “this appears to be one of the cheapest options to action – can be done very cheaply and offers the most benefits v least cost (apparently).” Other agreed suggesting it has “limited potential on its own– but if you bring this in in conjunction with forestry management then it seems like a really cheap and good way to capture carbon.” Some assembly members suggested it was costly not to protect peatlands and wetlands, saying “the issue is building in these areas and the small number of properties that are there. It’s costly to keep these areas dry, when it would be easier if they were wet.”

+ Public support

Some assembly members suggested that you “could use wetlands for leisure too”, that they are “good for leisure” and provide “good access for people.” Others commented that they are a “nice place to go for a walk – introduce children to wildlife (pond dipping, catching tadpoles...)”

One assembly member felt that restoring and managing peatlands and wetlands was a good idea in order “to have an impact on the landscape and farming practices as a signifier of what needs to be done to change our ways of living.”

+ Safety and risk

No assembly members made comments in this area.

+ Other

Some assembly members said it “delivers multiple benefits” or has “lots of benefits.” Some asked “why wouldn’t you want to do it!”, with others describing it as “effective”, a “win-win” or a “no-brainer.”

Some assembly members said they were “not sure why we’re not already doing it – doesn’t have any negative effects, is cheap to do, [and] has economic benefits after a certain period of time.” Others commented that it has “no real negatives”, “I like it – it’s not offensive to people”, or that they have “nothing against it.”

⊖ Cons

Assembly members identified the following areas as points that they disliked about restoring and managing peatlands and wetlands.

⊖ Environment impact and land use

Some assembly members disliked that restoring and managing peatlands and wetlands **“takes up a lot of space (land)”**, with some suggesting that there is “pressure on land use” or that it “could be a challenge finding adequate land for this.” Others described it as a “waste of land.”

Some assembly members said you **“lose the land for any other use (except leisure)”** or that the “land could be better used for other things e.g. food production.” Other assembly members said “population growth is an issue, which means we need more housing”, that “farming in the fens will be lost” or that we could “grow trees instead.” Further comments included:

“Would it mean flooding a lot of fertile areas e.g. around Norfolk, Cambridge? Do we want to abandon crop growing in these areas? Not sure [we] want to flood these areas outright.”

“The wetlands can’t be used for anything else, e.g. as opposed to forests. Although it won’t use up much land so it’s not depriving much land from being used in other ways.”

⊖ Practicality, efficiency, readiness and scale

Assembly members raised two **concerns about capacity and scalability**:

- **“Geographical considerations”** – a large number of assembly members commented that they were “not sure it [is] scalable”, that it has “limited potential, only some areas of the UK are suitable”, that there are “not many suitable areas” or that there are “limited areas for expansion.” Some said there is a “question of scale – [it is] not a major solution.” While others commented that “Doug [Parr] said there weren’t identified locations”;
- **“Limited capacity for significant CO₂ absorption”** – other assembly members said there “were also questions about whether established wetlands would be able to continue to capture more carbon or really just hold onto what they had already absorbed.” Some said “to capture CO₂ it must keep growing; what happens when it reaches equilibrium.”

Some assembly members summarised by saying you “can only do it in certain areas and those areas might already be done so limited impact.”

Staying with concerns about **impact**, some assembly member expressed scepticism saying it “seems that we just need to keep places wet? Only applies to certain areas of the country – how effective could this be?” or that “it’s nice on the surface, but will it be effective?” Others commented, “good [option]... – how much potential does it have though? How much CO₂ extraction exactly? If they dry out, what is released?”

Relatedly, some assembly members commented that it “can’t be [the] only solution”, that “we’re going to need multiple solutions” or that it’s **“not the whole answer**, won’t fix the entire problem.” For some assembly members restoring and managing peatlands and wetlands is “limited in where it can happen, [but] they mustn’t be allowed to dry out.”

A number of assembly members raised **climate- and season-related issues**:

"Concern about whether we can make sure it doesn't dry out – would this be more difficult as temperatures rise, harder to keep wet? This may be a bit 'chicken and egg'."

Similarly, some queried if it was "practical due to global warming", or noted that "climate change is affecting patterns of rainfall – would it cost to restore/keep areas wet, given that there is likely to be less rain in the future?" Other assembly members suggested that it "can sometimes store carbon in winter but release [it] in summer if it dries out", or that "in a very hot summer a fire could burn up a lot e.g. what happened in Yorkshire." Some said that it's "not viable long term" or that the "science is less certain about long term storage of the CO₂."

Some assembly members suggested that there would be "**issues with land ownership**" although some felt these would be "manageable with incentives". Others said they were "worried about it being down to landowners to maintain this unless they were given an incentive to look after it" or said they were "not sure it's practical to enforce land-use changes."

Some assembly members felt it "might be a **slow solution** – how long would it take to restore damaged areas?", while others commented that "it will take a long time to see the benefits, we need something faster." Some compared it to other options, saying the "length of time it takes to form peat: 1 ha of peatland vs. 1 ha of good middle aged forest. [...] Quicker to restore a forest, to grow trees than create a new peatland." Other assembly members disagreed: "Speed isn't an issue. We have until 2050 to reach net zero. 30 years to put it in place. If trees take 10 years to grow, that's fine. If these methods last a long time once they're in place, that's good."

Individual assembly members raised a number of additional concerns. One said "what will happen to buildings on existing wetlands?" Others worried that "flooding may be an issue, such as the wetlands in Glastonbury" or said "in East Anglia, for example, there isn't enough water for the new towns which are being developed so I don't know how there will be enough water to keep the fens wet." One assembly commented "given it can reach equilibrium, will need to remove peat and then burn it."

⊖ **Costs, the economy and jobs**

Some assembly members said the "**cost** and effort of land management" was a "downside", suggesting it was "hard to manage" or that it "sounds like a full time job to manage it." Others said it was "not a big enough impact to justify the sacrifice of land and the management cost." Some queried "if it comes down to time, resources and money is it the right ... focus? If we have limited resources, we should concentrate on the most **cost-effective** areas."

⊖ **Public support**

No assembly members made comments in this area.

⊖ Safety and risk

Some assembly members expressed concerns about the “releasing of CO₂ if the peatland is damaged” suggesting that there is “potential for it to go wrong if one of them dries out - a carbon bomb.”

⊕ Conditions

Some assembly members noted conditions around restoring and managing peatlands and wetlands – points they felt would aid its implementation or that should be put in place. They suggested a need to:

⊕ Combine it with other solutions

Some assembly members said it “needs to be part of [a] whole package” or “has to be done in combination with other measures.” Others said more specifically that it “would only really make a significant contribution if combined with good practice in forestry and soil storage as different things will only work in different areas” or that we need to “align this with the ‘what we farm’ options and preferences.” One assembly member commented:

“Peatlands and wetlands are an important investment that must be protected and expanded wherever possible. However, given that we only have a small amount of space suitable for peatlands and wetlands overall, we must also implement all other natural carbon capture solutions alongside to ensure we can capture as much carbon as possible.”

⊕ Consider impacts on farmers, farming and land use

Some assembly members said that “farmers need to change their methods” or more specifically that there should be “changes in wider farming practices in line with peatland/wetland management, eg ditches.” Others suggested that a “mechanism to compensate farmers needs to be in place.” Some assembly members said that “if crops are still grown, [I] would be in favour” or cautioned “don’t use all our cropland. Need to use the right land, e.g. moorlands where it’s not good for crops anyway. Don’t use fertile land.” Others asked for consideration of the “impacts...action today have on future opportunities such as farming and land use for the future.” More generally, some assembly members expressed “uncertainty over what will be lost.”

⊕ Manage it well

Some assembly members said it “needs to be well managed” or that they supported it “as long as [it’s] managed properly.” Others said that it “needs to be managed and monitored to ensure it is effective and carbon isn’t being released” or that it “needs management to keep the areas wet.” Others said we “need to make sure these areas are being restored.”

→ **Maintain but not restore**

Some assembly members said that existing peatlands and wetlands should be maintained, but that they wouldn't support restoring them or creating new ones.

→ **Bans, regulation and legislation**

Some assembly members suggested that “regulation is essential” or more specifically that we “should ban use of peat for compost” or that there’s a “need for governments to take a hardline against compost with peat as this creates a demand.” One assembly member said: “This should be done through very strong legislation to protect the areas from harm, including criminal sanctions for burning peatlands for grouse hunting.”

Individual assembly members said if it “means less use of chemicals, [I] would be in favour”, or expressed concerns about the destruction of peatlands to build windfarms. Others raised questions:

- “ What do utility companies (which have to pay maintenance / management) think of it?”
- “ National parks, charities etc already do it. Not sure how much is already happening.”

One assembly member suggested that “peatland and wetland re-wilding efforts should be done with the guidance of local environmental groups to ensure buy-in and support from the local community”. The same assembly member said we need to “put in place water supply back-up measures to prevent any drying or damage during our increasing heat-waves.”

As seen in Section A, assembly members expressed strong support for restoring and managing peatlands and wetlands in their votes.

B.3 Enhancing the storage of carbon in the soil

Enhancing the storage of carbon in the soil means changing the way soil is managed so that it can store more carbon. Assembly members discussed this option in small groups, noting pros and cons.

+ **Pros**

Assembly members identified the following areas as points that they liked about enhancing the storage of carbon in the soil.

⊕ Environment impact and land use

Some assembly members said that enhancing the storage of carbon in the soil “**improves soil quality**” or suggested there would be “benefits for farmers from soil fertility.” Others suggested there is a “general advantage to using soil wisely – it is common sense” or that it “must be a good idea – potential of carbon in the soil.” Others said “tilling carbon into the soil so it gets absorbed and enriches it ... [means it’s] more fertile, similar to [using] compost.”

Some assembly members said it would “contribut[e] to the health of the land and food grown through the use of **less chemicals**” or suggested more broadly that there would be “less pesticides”, and “less use of chemicals (fertilisers).” Some described it as a “natural process (chemical free)” or said it would involve “using natural fertilisers, rather than synthetic.” Other assembly members suggested there is “nothing to lose, I hate chemical fertilisers, we will get healthier foods, it’s a win/win” or said “we’re eating foods that come from the soil, so we need to make sure it’s of high quality and doesn’t contain anything that could jeopardise health.” One assembly member commented that a higher “quality of food [would be] produced....”

Relatedly, for some assembly members enhancing the storage of carbon was “a **natural** approach” or “natural-ish.” Some suggested it “runs with nature rather than intensive farming”, “doesn’t disturb the land” or stated that “even if it doesn’t capture that much carbon still prefer natural – reaching net zero is not the only thing that’s important.” Others felt it “has **added benefits (e.g. to the environment)**, that it’s “good for wildlife and birds” or that it “leads to good management of the land.”

Following a different train of thought, some assembly members commented “like this one, **requires changes to farming we would want to happen anyway**. It’s a win-win.” Other similar views included:

“Like that farmers have their way to make an impact – they have to pay a price. They know that they will have to be a big part of the action in the future.”

“Could also support the transition to layered farming, diversifying the food produced from a single piece of land.”

Some assembly members talked about a **return to the “old ways”**:

“It would be positive to go back to the old ways, using crop rotation, which is beneficial to carbon capture.”

“Out of the 6 methods [this is] probably the one I had least knowledge [of], asked the question and it’s like going back to the old ways of farming – instead of using modern fertilisers with chemicals, so [I] can see the advantage of that.”

“I live next to an arable farm, I have lived there 30 years, it was a quiet farm, used to leave fields to rest, but now it is so intense, they are growing things so quickly....”

Individual assembly members made a number of additional points, including that they liked that it “uses waste”, “enhances storage” or that it “doesn’t stop us using soil for crops, albeit different crops grown differently.” One said it would be “fast to absorb carbon”, another that a “no-till option should be considered.”

+ Practicality, efficiency, readiness and scale

Some assembly members described it as “**well understood**”, said “we have the knowledge and technology to do this” or that “changing farming methods is low cost and well understood.” Others noted that “some people are doing this already”, or suggested it would be “**easy** to implement”, “could be quite easily achieved with small changes”, “**can be done quickly**” or that we “can do this now.” One assembly member said they thought it would be “effective.” Another said it “might be more expensive than other practices... [it takes] much longer. [But it] [w]ill develop practices we can continue in the future. It’s long term.”

+ Costs, the economy and jobs

Some assembly members said it “is **cheap** to do” or “low cost.” One assembly member suggested it “needs more labour so creates more jobs.”

+ Public support

Some assembly members suggested it “may mean less production over time ...but at the same time **encourag[es] less food waste/changing diet** so this may not be a bad thing anyway...” One assembly member said that it “works for vegetarians (there will be less livestock production).”

+ Safety and risk

No assembly members made comments in this area.

+ Other

Individual assembly members made a number of additional points. One said it is “great in theory if it works.” Another that it has “no downsides.” One said that “all the previous options have a benefit and should be done [including this one]” or that we “do need to use this as part of [the] solution but in a limited way.”

One assembly member said they “saw an example of it being done on the telly – sounds interesting – documentary showed someone using direct ground sowing instead of ploughing. It was a researcher trying to get farmers to do it, but the farmer [him/her]self wasn’t that keen on it.”

⊖ Cons

Assembly members identified the following areas as points that they disliked about enhancing the storage of carbon in the soil.

⊖ Environment impact and land use

Some assembly members worried that it would mean **importing more food**, commenting “if we don’t grow it – it will have to be imported and that causes more carbon emissions” or “if we are not having our own facilities to produce livestock – where will it come from – it will have to be imported.” Some said that it “may lead to more food imports and the carbon footprint this would entail.”

⊖ Practicality, efficiency, readiness and scale

Some assembly members said that “farmers will be reluctant” or that it “will be **hard to make this happen**, to shift away from modern methods, there are vested interests in farming.” Others said that “farmers need to support it” or that “without financial incentives it might not work.” Some commented that “farmers will be slow to change their methods as [they] are very traditional – it’s passed through the family so very hard to change tradition.” Others said that it’s “difficult to leave land untouched in this way.”

Some assembly members felt it has “**limited potential** so don’t focus on this option”, that it “won’t be a solution in itself” or queried “how much [carbon] can soil absorb?”. Others suggested that “land saturates quickly, so not an on-going solution” or asked “after a certain amount of time the land gets saturated: how long can you store carbon? How long can you keep doing that?” Others made similar, but slightly more positive points:

“Feels like a temporary solution: what do you do once the soil is saturated? Adding carbon into the soil might have benefits though (i.e. water retention is beneficial)”

“...we should definitely do it, but it can only do so much, it may not be scalable to take in a lot of carbon compared to other solutions which take much more.”

“It would be a good idea, but it can only contribute so much to the solution.”

Others said it is “not done at scale right now” and “it would need to be used in conjunction with other technologies due to the limited capacity.” One assembly member commented that “it’s natural, but [I] like it less than managing forests as [it’s] less impactful and [I’m] less sure about how it works.”

Some assembly members expressed a different concern, noting “**uncertainty [about]... how long the carbon will stay underground**”, or saying they were “unsure of how stable this type of storage is.”

One assembly member suggested it “doesn’t work with other strategies for reducing carbon (which will also need land). Need to combine scenarios to see what feasibly works.” Another said we would be “less able to use this matter (i.e. compost material storing the carbon) for other purposes, e.g. as natural fertiliser.”

⊖ Costs, the economy and jobs

Some assembly members suggested that “less produce makes **food more expensive and [means] less jobs** – goes against progress made in the past. People can’t afford to pay for food any more.” Others worried about a “knock-on effect on...[the] **economy.**”

A number of assembly members said they disliked that we “will **have to financially support a lot of farmers** to do it – not sure how it can be low cost if [we] have to do this or where the money will come from given we will be losing EU subsidies too.” Others made similar points, suggesting it “could require financial support for farmers from [the] taxpayer – more expensive than peatlands or forestry etc” Others agreed that it will “need [a] subsidy for farming” or that it would result in a “lower profit margin for arable farmers, so needs subsidy.” Some asked whether the “costs of supporting farmers outweigh the benefits.”

Relatedly, some assembly members suggested it “**will take more work to farm**” and is therefore “asking a lot of our farming community.” Others said there is a “need for work to be done with farmers as this is a radical change”, or that “there needs to be support for farmers” who “are struggling anyway....” Some assembly members highlighted the **potential economic impact on farmers:**

“There could also be an economic impact on farmers if they aren’t producing as much food, the burden will be on them if they are making even less money.”

“Will lead to lower crop yields and possibly lower food quality which will mean lower prices for farmers.”

“Cost to farmers of changing their practices (because of need to disturb the soil much less), although they could develop new skills.”

⊖ Public support

Some assembly members noted potential impacts on **diets and lifestyles**. Some said that the “issue with crop rotation is food becomes seasonal” or asked “how comfortable do we feel telling people what they can eat and restricting their diets? I’m comfortable with eating a seasonal diet, but are we comfortable telling others what they can / can’t eat.” Some noted a “potential concern that it may not be healthier”, noting that “in [the] past government had to add salt and sugar to prevent dietary problems associated with seasonal diets.” One assembly member suggested it “could create friction as its hard to get people to change behaviour.” Another said it “will it have a negative impact on the food supply chain with the demand to grow crops quickly. This could act as a limitation for buy-in to this method.”

⊖ Safety and risk

A significant number of assembly members raised concerns about impacts on food production:

- **Food security** – some assembly members saw it as a “threat to food security” or asked questions about its security implications:

“...would we maintain [the] same level of self-sufficiency?”

“Will it affect food security in UK and can we afford to do it – will it make food more expensive?”

“Yield – Concern about lower yield of food and the impact this would have on food security. Will we be reliant on other countries, what will happen if there is another pandemic? We need to be more self-sufficient than we are as a country”

“Concerns about having left EU and whether dropping yields would mean less self-sufficiency.”

- **Crop yields and food production** – some assembly members phrased their concerns in terms of yields, saying it “will impact on yields”, or “could reduce the amount of food from the land.” Others suggested that the “growing of crops will be reduced” and that we “need to think about that given the level of food poverty.” Others thought it “may lead to loss in food produce – and while more natural processes are good, we do need to keep eating food.” Some said they are “not too keen on this one as it was changing farming practices that reduce yield at a time when we are talking about using more land for other energy practices.”

Some assembly members worried that it “can’t be good for carbon to be going into [the] ground or then our crops?” or expressed a “fear of carbon damaging the soil – least favourite of the options because of this.” Others said it “might cause problems further down the line.”

⊖ Other

One assembly member disliked that it “would need regulation.”

⊕ Conditions

Some assembly members noted conditions around enhancing the storage of carbon in the soil – points they felt would aid its implementation or that should be put in place. They suggested a need to:

⊕ Incentivise and subsidise farmers

Some assembly members said that “financial incentives [are] required”, that “subsidy and support for farmers will be key” or that there “would need to be subsidies for farmers to adopt these practices as it lowers the productive yield of the land area.” Others agreed saying to “get that kind of change of agriculture, it’s going to take financial incentives” and they “would have to be good incentives.” Others suggested that there is a “likelihood of needing to offer farmers grants to use this approach...” or that we “need to provide grants.”



→ **Combine it with other options and provide more information**

Some assembly members commented that it “would only really make a significant contribution if combined with good practice in forest, peat and wetlands management”, “if coupled with reforestation [it] might be a good option”, or that they’re “[h]oping there’s a hybrid solution that encapsulate the first 3 options and [is] not ... overly reliant on one or another.” Others made similar points, whilst also noting a need for more information:

“It can be done as well as – shouldn’t be instead of - may require a focus on getting information out to understand it better”

“As [with] the previous 2 options it can be done as well as. May require some focus and provide more information to help people understand it better but should be considered regardless of the other choices”

→ **Look at less essential areas first**

Some assembly members suggested that “air travel is a luxury – more pressure should be placed there” or commented that “farming is an essential industry – flying isn’t.”

→ **Tackle food waste**

Some assembly members asked “how much food is wasted currently?” or said we “would need to reduce food waste e.g. stop throwing away ‘funny-shaped vegetables’ – role of supermarkets is key.”

→ Think about where to do it and how land is used

Some assembly members said that it “must not be done on land used for farming” or that “if crops are still grown, [I] would be in favour.” Others suggested it “should be done where it can – every little helps” or noted “a lot of land [is] being used for golf courses in the UK. This isn’t essential. London has 11000 acres of golf course.”

→ Consider fertiliser use

Some assembly members said “if it means less use of chemicals, [I] would be in favour” or noted that “we don’t want [our] dislike of this option [to be taken to] mean that we’re totally on board with polluting land with lots of fertilizer.”

Others assembly members commented that we “need farmers”, that there’s a need to “get farmers involved” or that “farmers will need firm guidance.” Others said that the “focus should be more on growing more of what we eat so we can become more self-sustaining.”

As seen in Section A, assembly members expressed some support for enhancing the storage of carbon in the soil in their votes.

B.4 Using wood in construction

Using wood in construction means storing carbon by using wood instead of other materials to build houses and other buildings.

Trees naturally absorb and store carbon as they grow. This carbon stays trapped in the wood, again naturally, if they are cut down and used as timber in buildings. This process also creates space for new trees to grow and absorb more carbon from the atmosphere. An additional benefit to the climate is possible if timber is used instead of other materials such as concrete, which are currently manufactured with high carbon emissions.

Assembly members discussed this option in small groups, noting pros and cons.

⊕ Pros

Assembly members identified the following areas as points that they liked about using wood in construction.

⊕ Environment impact and land use

Some assembly members felt that using wood in construction was a “**good way to store carbon**”, with some comparing it to other options saying we “prefer [it] to CCS as [it] captures all the CO₂” or that it “locks the carbon in the building compared to BECCS which still releases some carbon back into the atmosphere...” Others suggested it provides “good long-term storage of carbon, while being put to a practical use.” Some commented that it is a “good building material – plus [it’s] natural and carbon storing” or, similarly, that it’s “a great construction material taking carbon out of the atmosphere – makes a lot of sense to be using wood as a building material.” Others said simply it’s a “good way to reduce CO₂.”

For some assembly members a positive was that it “**avoids more CO₂ intensive products** (e.g. steel/concrete)”, “reduces the need for cement and concrete” or would “change building practices away from using PVC etc which have negative carbon impacts in production.” Others said there would be “knock on benefits...[from] reducing the demand for concrete, iron and other materials”, or that it’s “not the golden solution but [we] should utilise it so that it replaces more carbon intensive material such as concrete.” Some labelled it a “low carbon building option, if they’re [the trees are] from the UK.” Others liked the reduced need to use bricks.

A number of assembly members said using wood in construction is “**sustainable** and practical”, a “sustainable approach – Australia [has] lots of wooden buildings outside of cities” or that “compared to BECCS this is definitely a more sustainable method – using the wood for construction rather than for fuel alone.” Others felt that “when [you] look at [the] long life cycle, it’s good” or that “when compared to [other] building materials the life cycle of wood has a lower overall impact on the environment.” Some said it’s “not the same as the deforestation in [the] Amazon – it’s just cutting fast growth timber from sustainable forests.”

Others suggested that “even if wood has to be imported it would logically be shipped which is a low carbon form of transportation.” Some assembly members suggested that “wood can be recycled – I use pallets in my garden” or that “wood used in buildings can be used and reused even if the building is demolished.”

Some assembly members said that they “like the idea because it’s **green** and because it doesn’t produce carbon dioxide” or that “using renewable materials is positive.” Some suggested it’s “**natural**”, a “natural option”, a “natural proces[s]” or that it’s “always been done and [is a] natural low cost way to store carbon.”

⊕ Practicality, efficiency, readiness and scale

For some assembly members, using wood in construction **works well with other greenhouse gas removal methods**. Some said it “will mean there’s a use for the increased timber that we’re growing”, that it will “use the wood from the forests we plant” or that it “combines the goal of forest growth and using the wood so that forests are regenerated.” Similar comments included:

“Works well with [the] idea of planting forests as [they] need to be planted on [a] long term basis to get large trees for construction – works well with forest management – need trees in different stages – can also help with BECCS.”

“Fits the jigsaw: grow trees and then do something with them, so the carbon is locked up.”

“Trees absorb the greatest amount of carbon in the early period of their life so when they’re felled that’s their productivity done. To use the material then makes sense. The natural technology locks the carbon for [the] lifetime of the build which can be for 20–40 years plus.”

Some assembly members were **sceptical about the potential negatives** of the method. Some noted that it “can be laminated/ fire- treated to be used in higher builds” or that “new tech, e.g. coatings, is improving quality.” One assembly member commented said that “personally [I] think it’s a great idea – asked Chris [Stark] on Saturday about what happened to buildings knocked down or destroyed where the carbon is released into [the] atmosphere but buildings in UK last longer up to a few hundred years so less of an issue when we are trying to reach net zero in 30 years.” Others suggested there is “not necessarily any difference in strength and appearance versus current [buildings]” or that wood “can be durable.” Some commented that they “feel positively about it because...[there are] very old houses e.g. in Stratford that have lasted for hundreds of years with wooden beams etc” or that we “have wood frame houses that are still here many years later...but do we have the skills to still do this?”

Some assembly members said that “wood can be used in lots of different ways” or that “wood is a very **flexible** material – can be used in lots of different ways in construction.” Others suggested that “you can build more quickly using wood – but this comes at the cost of being 10% more expensive” or that it’s “**quicker** to build with wood construction.” Some suggested it would be “**warmer** – wood houses are easier to keep warm than concrete” or that wooden houses would provide “better insulation.”

Some assembly members said using wood in construction is “**tried and tested**, practical, saves CO₂”, that it is “well used”, “being used already (USA, South Africa, Nordic countries)” or “we know how to do this already.” One assembly members said it is “simple.”

Individual assembly members noted a variety of other points. One said they were “excited by new engineering using wood”, another that it “creates a useful product which satisfies a national need”, another that it “grows quickly and [is] good for [the] purpose.” One liked that it is a “long-term project as [you are] growing trees over a long time and then using wood.”

+ Costs, the economy and jobs

Some assembly members suggested it “could be **cheaper** (as a material in construction/house price)”, or is “cheaper” or “low cost.” Others foresaw a “lower cost of house building, with pre-building off site” or suggested that “wooden houses / buildings could be cheaper – advantage for first-time buyers.” One assembly member described it as “more commercially viable.”

+ Public support

Some assembly members commented that wood is “**aesthetically pleasing**”, “pretty”, “a good and pleasant material”, or a “lovely material”. Others said they “love this idea – timber houses are beautiful aesthetically”, “[we] like a nice wooden house”, or we “love the architecture and wooden beams, but [are] concerned about safety and cost.” Some suggested it “looks nice – can be used for local businesses, smaller builds so not just homes.”

A number of assembly members were pleased that it “**can’t build tall buildings** as people don’t want to live in the air”:

“Like the idea that we won’t have as many tall buildings in our cities – like buildings that are in keeping with [the] landscape. After covid the increase in home working [means] we won’t need as many high rise office blocks. Some of these are redundant anyway – parts of the [hotel the assembly took place in] in Birmingham were not let; wasn’t really needed in the first place.”

Some assembly members said “we are **familiar** with wood building”, or that it’s “well known.” One assembly member suggested that “carpenters will like it.” Another liked the “opportunity to build more with wood.” A third felt positive about the “incremental change in the way we live.”

+ Safety and risk

No assembly members made points in this area.

+ Other

Some assembly members said that “in principle [it’s a] **good idea** to use wood” or that it “sounded positive – **can’t see any negatives.**” Others said it’s a “no-brainer as long as [it’s] used in conjunction with other methods”, that we “should use it where we can”, that they are “positive about it” or that there are “no downsides.” One assembly member said:

“Wood has been used for centuries when constructing buildings. It is probably the most common building material used in bigger countries such as America, Australia etc. We would also need to grow more forests/woodlands to supply the wood material over the longer term. A win/win situation.”

⊖ Cons

Assembly members identified the following areas as points that they disliked about using wood in construction.

⊖ Environment impact and land use

Some assembly members raised concerns about **imports and sustainability**. Some worried that “UK wood supply might not be sufficient”, said they had “concerns about there not being a sustainable source of wood to allow the scale needed,” or disliked that “in the short term, we’ll need to import timber to do this.” One assembly said:

“There’s a lot of construction going on in Cornwall [where I live]– need a lot more forest to match it. Scale not feasible, and amount of time needed to grow all the trees needed.”

Some assembly members asked “how do we know wood is coming from sustainable forests and not from other countries not done sustainably?” or said they disliked “importing from other countries (e.g. Baltic) if the wood is not from sustainable sources.” Others felt that “shipping trees from elsewhere to use in UK construction would be a problem because of the fuel used.” Some assembly members suggested that “lots of regulation [would be] needed to make this local and sustainable.”

Raising a different point, some assembly members asked “if this means low-density housing, do we have the space for that?” or said “lower density is more land – meaning that we have to build out instead of up.” Some assembly members expressed “concern about **land use**, other things may be more important e.g. forests and farming.”

⊖ Practicality, efficiency, readiness and scale

A large number of assembly members raised concerns around “**implications for building durability and strength**”:

- **Maintenance** – some assembly members said they had “concerns about the ongoing maintenance of buildings like this” or that they “will need...repairs.” Others talked about “wet rot, dry rot, pests” or said that wood buildings are “not so good for wear and tear: could be a problem with water and pest damage. Wood expands and contracts, can cause problems.” Some of these assembly members suggested that these were “hurdles we can get over probably.”
- **Quality and longevity** – some assembly members queried “longer term durability” or the “quality and longevity of the building.” Some commented that “industrial wood is different to nature’s wood – if they build cheap nasty houses, it will be a short-term solution” or that “timber framed buildings in 1970s turned out to be a disaster – had to be torn down because [they] weren’t built straight, wood got wet etc.” Others suggested wood is “not as permanent as steel or concrete.”

- **Life span** – some assembly members suggested that “timber frame houses have a short lifespan” or that we “need to balance [the] sacrifice of not using normal building materials with what the benefit is – don’t want to sacrifice something if have to tear them down and rebuild them in forty years.”

Other assembly members said that “brick homes feel more secure” or referenced the “three little pigs’ i.e. doesn’t seem sensible to build homes out of materials that don’t seem as strong as brick/stone.” Some said they were “unsure about their efficiency (heat/energy etc)” or queried **“whether wooden houses were appropriate for the UK’s climate.”**

Some assembly members disliked the **“difficulty of building tall buildings** with it”, that it “can’t yet be used for taller buildings” or that it “only works for low rise buildings.” Some assembly members suggested that not being able to build tall buildings “may be an issue with population growth”, commented that we “can’t all live in semidetached houses” or said that using wood would be “impractical for the big housing estates we need in the UK.” Others asked “what’s required for us to make the transition away from building very tall buildings in commercial use?”

Some assembly members suggested using wood in construction is “limited by the amount of wood available” or said they were “not sure what **scale** this can be done [at].” Others said it “can’t be done at [the] scale needed” or that there are “some questions about [the] scale of this – needs to be done with other approaches – like it less than forests and peatlands.” Some assembly members raised concerns about **capacity**, suggesting there is “limited capacity in UK – i.e. only need 330,000 new houses to meet demand, so where will we use the wood?” or said that there would be “lots of problems getting enough manufacturing capacity in the UK.” Some assembly members said it “takes a **long time to grow**” or asked “where is the wood going to come from? If it’s hard wood, that takes a long time to grow.”

A number of assembly members were **sceptical about the impact of wood in construction on emissions**. Comments included:

“If they don’t last long, you’ll be releasing carbon”

“Other technologies might have more impact – need to find a better concrete that is longer lasting and doesn’t use so much carbon”

“Materials used to make things out of wood aren’t so low carbon either e.g. plastics injected”

“Can’t absorb carbon once built (only store)”

“Potentially robbing Peter to pay Paul – would demand for timber decimate the forests?”

“Hard to see [a] major impact on carbon, won’t fix it all”

One assembly member asked “is there any political will – there was a Code for Sustainable Homes that was scrapped.”



⊖ Costs, the economy and jobs

Some assembly members raised “concern about **cost**”, suggesting it “might raise construction costs” or that the “current prices of wood as a building material seem to be too high for people to do this voluntarily.” Some suggested a need to “consider people who aren’t on the property ladder; will they be able to afford a property – they shouldn’t be burdened.”

A number of assembly members suggested that “we’d need a **new skill set and change to modern building practices**” or that there would have to be a “change to business skills e.g. brick layers.” Some asked, “would construction companies want to do it, given steel frame is quicker and easier to put up than a wood frame, and easier to shape? Do they have the skills, if they haven’t been using wood for ages?” One assembly member suggested a need to find an “economic balance with the take away from steel production.”

⊖ Public support

One assembly member felt that the “public will be sceptical.” Another raised a “concern this is being proposed by policy-makers to sidestep more difficult questions about housing stock – they should be focussing on making sure everyone has a home in the first place rather than using carbon reduction as a diversion e.g. addressing [the] high proportion of second homes in certain areas.”

⊖ Safety and risk

Some assembly members worried about “**fire safety and safety issues**”, asking “will houses burn?” or saying they were “worried about fire in cities.” Some said they had a “question as to whether the laminate made it safer” or asked “do the chemicals used as fire retardants have negative impacts on human health/emissions?” Others said there is a “greater risk of fire in properties built with wood”, while some talked about the Grenfell tragedy:

“Remember Grenfell tower. Reason why we use steel now is because of concerns over fire. It [wood] will also be weaker when it is wet.”

“The buildings burning down – concerned about lack of regulatory control (e.g. Grenfell) to manage this.”

Some assembly members expressed concerns about “risks of flooding and severe weather – how strong are they?”

➔ Conditions

Some assembly members noted conditions around using wood in construction – points they felt would aid its implementation or that should be put in place. They suggested a need to:

➔ Manage it properly

Some assembly members said they would support it “as long as it is managed effectively” or that “if it is done properly then it’s a good idea.” Some commented that “while off the top of your head you are thinking don’t chop trees... when properly managed it makes a lot of sense.” One assembly member noted: “*There are 800 year old buildings made of timber and very new concrete buildings falling down. It’s how we manage them that is the important thing.”

➔ Reduce fire risk

Some assembly members said that “growing the trees will take time, which will buy time for finding ways of reducing fire risk.” Others said they would support the idea if “the fire risk can be reduced” or if “there are ways to make it less flammable.” Some commented that it “must be fire safe.” Other assembly members suggested we need “legislation to ensure that building with wood is done correctly (addressing the safety concerns)” or that we “need robust regulation.”

→ Do it sustainably

Some assembly members said they were “happy as long as it is managed and done sustainably”, while others suggested a need to “regulate to ensure sustainability and keeping it local.” Some assembly members said it “needs to be done properly, using a tree at the end of its’ life” or that the “danger is trees are just used for building houses and felled before their most efficient period of capturing carbon.” Others said they “need to be built to last, with the right wood, otherwise carbon will be released.” Some said there is a need to look at “what happens to the wood afterwards” and that it “still doesn’t solve the problem of what to do with the timber at the very end of its life.” Others suggested that “unless you set up a good recycling system with CCS” the end of life question was “a risk.”

→ Consider which building to use it for

Some assembly members said that “demand for new houses should be met by using timber” or “definitely for new build houses but not for hospitals and key buldings.” Conversely others queried, “our building stock is old...how much new construction will there be?” Some assembly members said they would “like to use it where we can but not to the detriment of the safety/ longevity of a building.” Some asked “can terraced housing be made of wood? This needs a mindset change to buy and maintain buildings like this.”

→ Think about other uses too

Some assembly members noted that we can use wood for “furniture, doors, houses”, or said “we need to cast our imagination wider, use it for bridges, infrastructure etc.”

→ Use UK trees and fit plans to supply

Some assembly members said they would support it “if we can use UK trees”, that it’s “less advantageous if we have to import wood” or that it “needs greater supply of UK wood (would defeat purpose if wood was imported).” Relatedly, others suggested that “scale needs to be limited to supply.” Some assembly members pointed out that some “cement is made abroad.”

→ Develop skills, technology and infrastructure

Some assembly members suggested that “we need to learn the skills to build and maintain the buildings” or that “we need time to develop the skills to do it at scale.” Others said that it “needs further development e.g. lamination method for strengthening wood” or that we “need factories to process the timber and build the sections for the buildings.” Some asked “Government to incentivise [the] building industry to change and re-skill.”

→ Think globally

Some assembly members felt it “requires [a] global response” and is “more suitable for some countries than others.” Relatedly, some assembly members talked about their own experiences abroad:

“Lucky enough to spend a year in California and 2 years in Japan, earthquake areas, don’t build with bricks. Normal domestic buildings are made of wood. ... don’t have the longevity – 30 years maximum – striking. Don’t expect the longevity of brick building. Talking to people – living in rural Japan: when a couple gets married, they build their own house, there is no second hand house market – very different approach. Heard it said: you plan a brick building to last 100 years in the UK. More in tune with current living – decades vs hundreds years. If you build houses every thirty years, it is more in tune with the way we live currently.”

“Relatives who live in the US. Even in New York – lots of wood in building – cheaper to build, and it does decay – have to change panels...”

Other points made by individual assembly members included:

- “ ...should be done in factories to be more efficiently built – built to the way you want it – ... build faster/ ensure less waste – go for wood – the way we build now is not efficient.”
- “ ...would need to be mandated to create the economies of scale that would make it an affordable option for builders, particularly in larger commercial buildings.”
- “ Happier for longer-growing trees.”
- “ Need good quality timber and timber products.”
- “ Treat the wood, but take care what chemicals used.”

In the votes, assembly members expressed strong support for using wood in construction. Please see below for the results of the votes.

B.5 Bioenergy with Carbon Capture and Storage (BECCS)

Bioenergy with Carbon Capture and Storage (BECCS) means using wood or crops for energy, capturing and storing the carbon dioxide released when they are burned. Assembly members discussed this option in small groups, noting pros and cons.

+ Pros

Assembly members identified the following areas as points that they liked about BECCS.

+ Environment impact and land use

Some assembly members said that there's a "place for it because of the energy it creates and can be used for" or that it's a "carbon-neutral way of getting energy." Others liked the energy production but at a small scale:

"Energy production and captures positive elements – but for use at a small scale"

"For heating – small plants could be useful, could have its own role. Still, not to that large extent where you have a massive power plant."

One assembly member said it "encompasses lots of good elements, but not at a large scale."

Some assembly members said they were "not massively positive about this option but do like idea of growing crops and plant material to burn for fuel...." Others said "I quite like it – use the trees we're growing" or "the idea is good – **use what we grow.**" Some suggested it's "**sustainable**, once [you've] used the crops you can regrow." One assembly member said it's a "natural fuel [and a] win-win. The carbon has been absorbed recently." Others argued:

"The wood that is imported is fast grown in places where it makes sense to...[grow] them, shipping the wood is low cost in terms of emissions. When turned into pellets and burned using this technology for energy and subsequently capturing the carbon for storage it is a virtuous circle that has got benefits to it."

Some assembly members said they liked it "**if it is making use of waste** products to generate energy" or that the "only advantage to this would be if you were burning waste."

A number of assembly members said "CCS will be a game changer", "with the CCS attached – there is a **huge impact**", or it "should have a large effect." Others suggested that it's the "greatest chance of getting us to net zero in the timeframe" or that it "does a lot in a short space of time." Some talked about the "sheer volume of carbon dioxide we can achieve through this approach", with some commenting it's "more...than the natural options." One assembly member said "BECCS is my first choice because of the sheer volume of removal of CO₂." Others similar comments included:

"Think it will be effective. Will be higher in cost than natural approaches but we are going to need to spend some money to make a big difference."

"Come round to BECCS compared to before – if it's done properly it can be hugely positive, given how much CO₂ this method can take out of the atmosphere. Needs to be regulated to ensure its done in the right way – i.e. not growing forests just for the sake of burning wood."

+ Practicality, efficiency, readiness and scale

Some assembly members said BECCS “**has a part to play along with other solutions**” or that it “should be part of a broad range of solutions – we have to try everything.” Others said that it “can take up [the] remainder after other methods [are] exhausted - has potential” or that it “would be OK in moderation, but prefer natural processes.” Some assembly members said “we do need to keep the lights on when the wind stops blowing – analysis seems to show we’re still going to have to use gas – so CCS is needed (although not necessarily BECCS).” Some commented that “technology is an important part of the solution.”

Some assembly members suggested that “in the future, there will be a lot more bio-energy. [...] ... there is potential – option worth considering – in 100 years, might be the main method we are using for energy. That **might be the future.**” Others made similar points:

“My favourite option – I understand that it takes time. Even if it captures 60% now with the tech we have in the future it will become more efficient.”

“This is probably the way forward. Use the trees to heat our homes.”

A number of assembly members noted that a **range of resources needed for BECCS already exist**. Some said “we have the plants needed for the biomass” or that “existing power stations can be converted.” Others said that “we have enough storage space” or that the “storage is there”. Some mentioned it “seems good in theory that we can use the empty space left by oil and gas extraction to store carbon” or talked about the “potential of so many empty gas and oil fields in [the] north sea that it could be stored in... expensive to get them there, but would revert to a solid over time.” One assembly member commented:

“I was very opposed to CCS initially, I was imagining CO₂ ready to leak out, but Chris Stark talked about it bound in the rocks: no possibility of leakages. Doesn’t create risks for future generations. [My] [o]pinion about CCS shifted a lot...if carbon is bound in a solid inert form under the sea, with no risks of escaping, much more keen....”

Some assembly members suggested BECCS is an “**end-of-life solution for timber** which has been used in construction” or that “if we have to renew the forests – then it seems to make sense. It’s better as a by-product instead of for its own sake.” Similarly other assembly members commented:

“If done well, it’s a plausible idea. For example, the forests need to be well managed and the biomass should be created as a by-product of other processes.”

Some assembly members said we have “**good knowledge of how it works**” or “some proof/maths that it can reduce the problem.” One assembly member said it’s “achievable.” Another said “my own experience of heat networks is positive.”

+ Costs, the economy and jobs

Some assembly members talked about an “**economic revitalisation potential** (e.g. Teeside)” or said they “like [the] idea of converting old coal fired power stations to biomass, you can employ the same people.”

⊕ Public support

Some assembly members said it “will make use of industrial expertise, technological knowledge, it will create lots of interest – **it’s a 21st century solution** which will be appealing.”

⊕ Safety and risk

One assembly member felt “reassured regulation will make it safe.”

⊕ Other

Some assembly members said they **preferred BECCS to other options**. Some commented it is “better than the soil option if you can contain the CO₂” or that it “seems a better idea than the fossil fuel power plant CCS.” Others suggested that it “offers things that other processes don’t. It can be used for essential fuels instead of fossil fuels e.g. aviation.” Some suggested that it “may be more effective than other options.” One assembly member said “I like the concept.”

⊖ Cons

Assembly members identified the following areas as points that they disliked about BECCS.

⊖ Environment impact and land use

A large number of assembly members suggested BECCS **failed to address the problem**. Some said they are “worried that it takes the focus off the amount that we are emitting in the first place” by sending “the message that there is a magic technology taking carbon out of there”:

“Just using technology to hide our own mess for the future. It’s not a solution. We need to change our way of living and not just rely on tech to clean up our mess.”

“They are only capturing the CO₂ they have produced in the first place, why not not produce it in the first place.”

“Not convinced that this will actually reduce carbon, will just be taking out what it puts in.”

Similarly, some assembly members said we “can’t always rely on a quick tech fix” or suggested that “this is being pushed politically – a tech solution is politically more convenient than the behaviour change options that are needed.” Some said they “don’t see it as a very long term solution” or commented:

“If net zero is meant to be about securing the long-term / our children and grandchildren’s futures then this seems like simply pushing the problem under the carpet for others to solve later.”

Relatedly, some assembly members noted “concern people will get carried away with technologies like this, we mustn’t rely solely on new technologies and simply carry on as normal. **What happens if it doesn’t work?**” Others said it “seems like doubling down...If it works, great, but if it doesn’t we’re screwed.” Some assembly members asked “what if we waste 10 years and don’t get the carbon reduction we need?” or “if we still have this problem in 100 years what happens then?”

Some assembly members raised further points about its **impact on emissions**, noting that it “only takes in a certain amount – not net zero in itself” or commenting “as a concept it seems very difficult to imagine how it achieves net zero, might it cause increases in CO₂?” One assembly member noted that you “need energy to do this.”

Some assembly members disliked the “**amount of land it will need**”, felt it “needs lots of land (if at scale)” or noted “concern about biomass and too much land take if people get carried away.” Others suggested it “takes up a lot of space that could be used for a lot of other things e.g. crops or forestry or houses”, “uses up land that could be used for other purposes” or said they were worried about the “impact on food production and biodiversity.” One assembly member commented: “At the risk of being wrong: we’ve not been self-sufficient in food since before WW1, I’d prefer food security as a priority.”

Some assembly members disliked “**imports** from other countries” or queried “can we grow enough? Will we have to import fuel?” Others commented “really against this – the ethics of where [we’re] buying this from...”, or “didn’t realise we may need to import trees to use for bioenergy for this – this defeats the purpose of trying to get to net zero.” Some asked, “would some of the trees need to come from abroad – so there would be shipping costs and emissions from shipping – seems ludicrous” or noted “at Drax, wood is converted to chips and dried. Theirs is from Sweden and the US. It goes through several stages before it is burnt.” Some assembly members said:

“...biomass burning is currently using trees from the United States where there is less regulation compared to other countries. They have been known to fell old growth forests to chop down into wood pellets to burn – so actually by burning such wood this carbon is released back into the atmosphere that would otherwise have been stored in the trees...”

Some assembly members commented “don’t grow trees to cut them down and burn them”, it’s a “bad thing if we are **just planting things to burn**”, or “growing stuff to burn it...conflicted by the burning element, hard to tolerate. What are the real implications at scale – is it feasible.” Others said that they “don’t have a problem with capturing carbon, but [it’s a] bad idea to be burning wood, might as well burn coal and capture that.” Some suggested it “seems to be a long way round – to grow trees, burn them and then capture their emissions.”

Some assembly members worried about the “**impact on wildlife**” or said they were “worried about nature e.g. birds nesting” when forests are thinned. Others suggested there is a “risk of changing the make up / health of the oceans” because of where the carbon is stored.

One assembly member said I “generally, prefer more natural solutions e.g. forest management.” Another commented that they “can see problems with deforestation – timber has to come from somewhere – can’t believe it’s a viable proposal.”



⊖ Practicality, efficiency, readiness and scale

Some assembly members said they are “sceptical of the whole thing given it hasn’t been tested fully to any **scale**” or suggested there is “no proof of doing it at scale.” Others had related concerns, querying its “feasibility at scale – high cost, infrastructure?”, or asking “will it be very local, e.g. heat networks? Is it plausible across the country?” Some questioned “is there enough biomass?”

Relatedly, some assembly members said that the “technology is new”, “**not proven**”, “not well understood” or that they are “not convinced it is viable.” Others commented specifically that “carbon capture is new, not well tested – will it work?” or suggested “we don’t know if it actually turns back into rock,” or that there is “no evidence of how the natural rocks in proposed storage sites will really react to the ‘carbon sponges’ over time.” Some suggested that the “**technology doesn’t even exist yet** – it’s ‘pie in the sky’.” Others queried “will it be done on time?” or commented “at the moment we have no way of carbon capturing – plant was supposed to be built 5 years ago....”

Some assembly members felt BECCS is **less preferable than other energy sources**. Some said that we “may as well use coal” or that “if you’ve got the carbon capture technology, why not use it for gas and coal – industrial revolution showed we moved away from timber burning for a reason, it’s inefficient – leave it in the timber in the first place.” Others suggested it “only takes carbon out of the atmosphere to the extent that it reduces other forms of power generation. So, does it make sense to do this at all – should we not, for example, use wind power instead?”

Some assembly members suggested that “**having enough storage is a challenge**” or that it “sounds good on paper but how much space under the ground will it need?” Individual assembly members commented that it “would need a lot of infrastructure”, or that “I don’t like the idea of storing CO₂: much better to create synthetic fuels....” One said “pellets are an issue – it’s complicated.” Another assembly said that “burning wood for generating electricity is a very inefficient method. For the same of amount of electricity generated, it creates 4 times as much CO₂ as natural gas and approximately 1.25 times more than coal. Also, it has a very low energy density, and you need a lot of it. So it’s not a very efficient or effective method of generating electricity, or reducing CO₂.”

⊖ **Costs, the economy and jobs**

Some assembly members talked about “**high costs**”, “very high cost” or “expensive capital.” Others said it “seems like a higher cost than other solutions”, that it’s “too costly therefore not feasible” or that the “initial high cost would put people off.” Some said it’s “expensive (particularly when the investment is in an unknown outcome).” Some assembly members asked “would people be willing to pay?”, “will government pay?” or “who’s going to pay for the buildings needed? Tax payers or private companies?” Some assembly members suggested “there would be a lot of costs involved in re-skilling and re-training people to grow trees.” Others noted “cost....[is] expensive, although will there be a bigger reward in the longer term?”

⊖ **Public support**

Some assembly members said they disliked “**transport** options [for] getting the fuel to the plant” or that “Drax has huge trains bringing fuel to the plant.” One assembly member said: “[I] live next to a biogas plant: doesn’t have CCS. It is a nightmare because the farmer is supposed to grow maize to supply the plant – hundreds of trucks coming in and out of his farm for about a month: creates a lot of emissions. [...] Huge amount of maize is imported: keeps the plant going for the whole year. Should not have had the go ahead. He is not operating the plant as he should do.”

⊖ **Safety and risk**

A very large number of assembly members said they were **worried about leaks**. Points included:

- **It’s a risk** – some assembly members commented that “there are many examples of things we previously believed were safe and now know they weren’t – it’s [carbon storage] a risk we don’t have to take”. Others said they “wouldn’t feel confident that the carbon wouldn’t escape”, or that it amounted to “taking [the] problem out of the air and putting it in the ground, not solving anything, it might leak out there.” Some suggested that the “carbon store part is a concern. Time only will tell if it’s a viable option, not enough information to know at this point.” Others suggested that “CO₂ under pressure is used to drive out oil, but when stored will high pressure CO₂ create earthquakes and the release of CO₂? It’s not viable long term, risks [are] too high”;

- **Distrust of man-made answers** – some assembly members suggested that “nature approaches can’t go that far wrong, but this can really go wrong – high risk – don’t feel there is proof that this will work e.g. leakage, problems with transport.” Others said “we don’t know enough about [the] dangers of man-made solutions – it’s all new and [the] risk is too high” or that “all the man-made solutions have the potential to destroy, ... need to keep them to a minimum...”;
- **Potential for disaster** – some assembly members talked about a “risk of accidents and CO₂ being released back into the atmosphere” or said they are “very concerned that it’s speculative and what will happen if it fails, if the CO₂ escapes? An uncontrollable disaster? CO₂ is a big risk as a stored gas, uncontrolled release.” Others talked about a “risk that in 10, 20, 50 years time there could be a massive carbon release as sites fail and this could lead to environmental melt-down.” Some asked, “what happens if there is an earthquake?” Others said “it’ll work but burning and storing CO₂ is dangerous, therefore build demand for other options e.g. using wood for construction, synthetic fuels.”

Some assembly members said they “would rather have a small amount of nuclear waste in the north sea than a load of carbon dioxide” or that it “feels like burying rubbish underground.” Others had concerns about “transport to storage in oil fields”, with some suggesting it was a “terrifying concept – 50m tonnes of CO₂ being transported. That’s a lot.”

⊖ Other

Some assembly members said there is “too much push from industry on this – are they influencing the climate change committee?” or that “CCS feels like a bit of a PR stunt, pushed by big companies. But a tree can already do this.”

One assembly member said I “don’t see BECCS as a solution – burning something so quick that could be used for construction – can’t capture all of the carbon – feel like it’s wishful thinking that this could be the solution – should be considering the other options – massive amount needed to grow to meet need for something that is going to be used up very quickly, which leads to massive deforestation.”

⊕ Conditions

Some assembly members noted conditions around BECCS – points they felt would aid its implementation or that should be put in place. They suggested a need to:

⊕ Think about scale

Some assembly members said we should “use [it] as a small scale solution” or that it “would be OK as long as it’s done in moderation.” Others said “75% BECCs is too much, use other options.”

→ Only use it where there is no alternative

Some assembly members asked “could it be capped...to air travel and agriculture: could it be restricted to meet the needs of what can’t be reduced?” Others said it’s “fine when used for essential fuels e.g. bio fuels for airplanes, where only alternative is fossil fuels.”

→ Use natural approaches first

Some assembly members said we “need to prioritise natural options”, “need to use up options 1–3 first before resorting to this” or “should be using natural approaches straight away as we know they will work and use these technologies in the background as over time we will understand them better, they will improve, cost may improve.” Some commented that we “need to have some more reliable forms of energy for when not windy etc, so carbon capture is helpful for those times – didn’t like idea of burning wood for this – if this is necessary then fine but sceptical on cutting trees down to burn them when we might as well keep using gas and capture carbon from that.” Others suggested that “historically, carbon has been stored in the soil and converted into oils and diamonds, and coal etc... We need to push that carbon option. “

→ Undertake research and development

Some assembly members said it “needs further development” or “needs to be encouraged. [...] Let’s put money and investment and explore.” Others commented “if these CCS techniques improve, if storing in geological space if safe, then it’s possible.” One assembly said it “needs more funding to improve the system and ensure Carbon Capture is secure.”

→ Consider which raw materials to use and where they come from

Some assembly members said they would be happy “only if we use waste products, not if we import” or that we “must focus on doing this with waste – don’t use ‘useable’ materials for this.” Some said “with wood – must use waste, eg from the ‘wood in construction’ option.” Others said “don’t import materials for this method” or suggested that “using this method would require close regulation to ensure practices such as those in the US are not repeated here.” One assembly member commented: “Bioenergy with carbon storage seems to be a fantastic carbon neutral source of energy. However, the biomass needs to be from the UK and not imported.”

→ Consider and manage risks

Some assembly members said we “need to weigh up the risks and rewards”, that “storage facilities need to be well managed” or that “I would be in favour if it was proven it would be 100% secure.”

→ Queries around funding

Some assembly members said they would be in favour “if the cost can be reduced.”

Others raised queries:

“There was funding by the UK to create a CCS facility – it was abandoned as economically unviable. Why did this happen?”

“Why hasn’t the government supported this – is it because of the cost or because the science isn’t there?”

→ Must not be used for enhanced oil recovery

Some assembly members discussed that any carbon captured “must not be used for the process of enhanced oil recovery” saying it would make BECCS “entirely self-defeating and will lead to even greater emissions.”

Individual assembly members commented that it “needs to be part of a range of GHG [removal] measures”, that it “must be done sustainably, eg no fertilisers to rush growth”, or that “technology is great, but humans need to start taking responsibility for our impact on our surroundings.” Others individuals said they would support it if “we use reverse pipelines to transport the carbon to the storage area” or “if we can meet the capacity for this and Wood for Construction.” One assembly talked about their own experience of living next to a biogas plant, already noted above:

“ Need controls: otherwise causing so much trouble. Planning application required that he grew the maize himself. He is not operating the plant as he should. Reported. Inspectors. But there’s a line of communication between him and council officials from the local authorities.”

As seen in Section A, assembly members expressed limited support for BECCS in their votes.

B.6 Direct Air Carbon Capture and Storage (DACCS)

Direct Air Carbon Capture and Storage (DACCS) means using technologies to capture carbon dioxide directly from the air, then storing the carbon. Assembly members discussed this option in small groups, noting pros and cons.

+ Pros

Assembly members identified the following areas as points that they liked about DACCS.

+ Environment impact and land use

Some assembly members liked that DACCS “can be located at sea so **not using land**”, that we “don’t need to grow anything – land can be used for other things” or that it’s “not taking up land as much.”

Some noted that it “**can capture a lot of CO₂**” or “could take more carbon out than just net zero.” One assembly member commented: “I believe the direct carbon capture and storage will actively address the challenge we face of removing carbon by 2050.” Others said it’s a “really good idea – has the potential for large capacity.”

Some assembly members suggested DACCS is “**very clean**”, “cleaner” or that it meant our “energy requirement can be met by clean energy.” One assembly member commented: “I feel this is the cleanest method of removal with the smallest carbon footprint associated with it, that has the most capability for significant removal of CO₂.”

+ Practicality, efficiency, readiness and scale

Some assembly members said it “**can be located anywhere**” or that it doesn’t “need to attach next to a power plant, can put [it] wherever.” Others suggested it “could be carried out close to the storage spaces (e.g. offshore, or close to offshore connections) so reducing transportation compared to other CCS options” or that it “can be located to reduce [the] cost of transport.”

Some suggested it “can be placed beside off shore windmills which seems like the perfect solution”, that it “**could be wind powered**” or that it “could be done at sea e.g. powered by wind farms.”

Some assembly members labelled it “part of the mix of options to remove GHG” or felt it “has potential as **part of the mix of solutions.**” Others said it “doesn’t hurt to have it – not a huge part to play but every little helps? One of many parts of the strategy”, that it’s “possibly a quick solution if all other measures fail” or that the “only real positive could be that it’s an in-between solution.” Some assembly members felt it’s a “good idea, but shouldn’t be done on its own. It is a new tech and so we don’t know how effective it will be or how cost effective – should be a back up option but not the main part of the approach to net zero.” Others said it’s “**good to develop new technologies**” or that “science can help us and innovation can be used to remove the excess CO₂.”

A number of assembly members noted that we “have the North Sea for storage” or that the “**storage capacity exists** (under the north sea).” Some liked the “**simplicity** of the method” or noted that “one of the speakers described it as a floating boat stuck next to a power plant in the north sea...if it’s as simple as that, it sounds OK.”

Some assembly members suggested there was an “**opportunity for international collaboration**”:

"This needs to happen, but could be more effective elsewhere in the world, e.g. set it up near the equator to use solar energy, run in partnership with the UK investing."

"Saudi Arabia would be a good place to develop this, with the sun for renewable power and all the ex-oil storage. We should be thinking about worldwide approaches here."

Individual assembly members made a range of other points. One said I "quite like the idea.... How big would the plants be? Would we have fields of direct air capture like wind turbines or would we put them out to sea?" Another said "the mechanical units can be small, don't have to be big." Others noted that "lots of research has been done" or that it "only takes 2 years to convert it to rock. I thought it would have been much greater than this." One suggested that we "could use the carbon captured for useful things like carbon fibres (same for other CC technologies)." Another said I "prefer it to BECCS." One said there are "no physical inputs [of biomass] required."

⊕ **Costs, the economy and jobs**

Some assembly members suggested that we "will start to get a return which will drive down costs", that "**costs could fall**" or that the "cost could come down over time." Others suggested it "may give the **biggest bang for buck**", or that "oil and gas companies will make it viable and **will make money from it.**" One assembly member said it would "create jobs, lots of people involved in the research side."

⊕ **Public support**

No assembly members made points in this area.

⊕ **Safety and risk**

No assembly members made points in this area.

⊕ **Other**

Some assembly members said it "has the right end goal" or that they "**feel positively about the idea in theory**, makes sense to me." Others labelled it a "good idea in principle but [the] technology needs to develop" or a "good backup – continue to research into it..." Others said "what's not to like from the concept? Removes carbon from the air no matter what the source" or "great if it works, could be a good idea, keep researching, but the main focus should be other areas." Some assembly members commented:

"What is wrong with spending money on it. You have to invest to make something work. I'd like to see Government step up and give it a go. Another potential benefit of the impact of Covid where we saw the impact of engineers on making ventilators – can't we harness the same process."

⊖ Cons

Assembly members identified the following areas as points that they disliked about DACCS.

⊖ Environment impact and land use

A significant number of assembly members said that DACCS is “**not as natural** as other options”, that they “prefer natural solutions” or that “if it saves the same amount as natural options, then would prefer the natural.” Others said that “it’s a gut instinct that it goes against nature”, that it “feels like trying to create technology to do what nature should do” or that we “should not need to be investing in new technologies when there are better solutions to minimise carbon release and maximise carbon storage naturally.” Some feared it “takes away the focus from natural processes available now - too many questions as to whether the technology can be invested in and developed in the long-term and whether in the end it can do what it intends” or suggested “this is just what a tree does – unless this is going to do the same job of thousands of trees, don’t think it’s worth it. Should just plant trees instead.”

Another significant number of assembly members suggested that “**we should try to reduce the carbon emissions, not just capture them** once they’ve been emitted.” Others said it “seems like playing round the edges rather than tackling the problem of reducing emissions”, that it’s “like burying problems and putting your head in the sand”, that it “potentially lets companies off the hook from changing other practices” or that there’s “too much pushing of ‘carbon storing’ options which just kicks [the] can down the road. Need lifestyle changes instead, and the associated public information exercise.” Some assembly members said it “should not be used as an excuse to carry on using fossil fuels, need to find better ways forward”, that we’re “concern[ed] this will let us slip back to using more fossil fuels” or that it seems “reactive rather than proactive.” Similarly some registered “concern that it will be ... treated as magic solution and we don’t do other important things before 2050.” Others noted “concern people are jumping on things that will create jobs, we should make sure it’s going to reduce carbon emissions to the extent we need it to.”

Another significant number of assembly members disliked that it “**needs a lot of energy**”, the “energy it takes”, that it’s “very power intensive” or that it “requires electricity to run in the first place.” Others suggested that its “energy use can defeat [the] purpose” or that “this will need loads of CCS and the carbon capture uses lots of power so we might get into a spiralling situation.” Some noted it is “energy intensive to run so still needs to be fuelled – inefficacy”, that you “need power to run a pipe for the CO₂” or that it “only works if using low carbon electricity sources, not if using high carbon electricity – requires lots of low carbon electricity.” Similarly, some said “this also relies on the energy used to power the technology being produced in a carbon neutral way, which may not be the case so seems counter-productive.”

Some assembly members said they disliked the “**land use** implications”, that it “requires lots of land for the fans” or that it “takes up a lot of space that could be used for a lot of other things e.g. crops or forestry or houses.” Others asked “what about the land take (especially with take from wind farms)?” Some worried about “where will they be put, **impact on people**, land take, **visual impact**” or about “visual and noise impact.”

A number of assembly members felt there were “**no multiple benefits** (as with forests/peat)” or that the “only benefit with this one...[is] storing carbon” while “other options” had benefits including “biodiversity benefits from forests.” Some said “even BECCS” provides “energy you can use.”

One assembly member suggested “it’s being pushed by big companies. It’s a back-up plan for moving away from oil, as profits go down from that. It’s a nice tidy way to dump things in the ocean.” Another referenced the “example of ‘enhanced oil recovery’ practices used since the 80s to enable access to further reserves of oil”, noting “concerns that this practice could be continued via this technology” and lead to increased emissions.

⊖ **Practicality, efficiency, readiness and scale**

A very large number of assembly members commented on the **newness of the technology**. Suggestions included that it is:

- **Unproven and untested** – “Tech isn’t proven yet” “Seems too simplistic, untried and untested. Sci fi.” “Not tested, not proven whether effective, not tested at a large scale” “Not practical and the technology is still unproven” “We don’t know if the technology works”;
- **Experimental** – “Experimental” “Very experimental” “Still experimental” “Still very experimental - a long way off, can’t really depend on it like you know you can depend on forests doing this – one for the future – rather than for now.” “Not convinced it will work and if we know enough as tech is new and experimental”;
- **Theoretical** – “Very early stages (theoretical) and futuristic and not well understood” “It’s still theoretical. Not done on a large scale. Where can the carbon be stored reliably?” “Sounds too good to be true. It’s great in theory but not actually working.” “Technology is not there yet. Cautious about having air capture devices. Almost theoretical at the moment, might not be ready for the next 30 years. Not on the priority list”;
- **Not far enough developed** – “Early technology so unsure if practical” “Not far enough developed to make a big impact” “The technology doesn’t exist yet” “Technology again. The technology is just not there yet” “New technology, not sure exactly how it works yet” “Too unknown”;
- **Far-fetched** – “Sounds far fetched / a lot of unknowns” “Fanciful – seems like magic.”

Some assembly members said simply that it was a “new method.” One said it was “vague.”

Some assembly members queried “is it **scalable?**” or noted that we “can’t do it at the moment, at scale.” Some said it is “**not practical for the short term**” or is a “medium term option, but prioritise everything else. Putting all the resources in options we are not sure about is not the best idea.”

Some assembly members said they were “**sceptical they can get as much carbon as they say they can**” or that they thought it would be “limited in terms of [the] amounts of CO₂ that can be extracted.” Some commented that it is “**very inefficient** – has this just been pitched to make the other option (BECCS) more efficient? Don’t know why it’s on the list.”

Some assembly members suggested **other options are better**. Some said it “seems to have a lot of similarities with BECCS. BECCS could be better potentially. But it is hard to tell, still pretty theoretical.” Others said they were “not a convert. They have been looking at it for a while. Big investment: will take a long time to build. Could be worth investing, but it is so uncertain: but could be a huge amount of money. The other options are so much easier to reach net zero.”

Some assembly members suggested there is “**no commercial interest** without Government sponsorship or investment” or that “one of the biggest problems with carbon capture was getting people to invest into it which has been the case for the last 20 years. Not sure if priorities on this have changed enough.”

Individual assembly members said they “don’t see it as a very long term solution”, or that it’s “very difficult as the main place for capture will be at power stations.” One asked “where could these be sited? Would every village need one or would large industrial units need to be built to capture and store?”

⊖ Costs, the economy and jobs

A large number of assembly members said it is “very expensive”, “**expensive**”, “high cost” or “likely to have a very high cost.” Some assembly members highlighted the “initial cost” or “cost of installation” in particular. Some assembly members disliked the combination of uncertainty and expense:

“High cost – put the money into something [we’re] more sure will definitely work.”

“More money and doesn’t have a guarantee of success.”

Others suggested that the “money could be better spent in other areas” or that it “does the same job as a tree but [is] expensive.” Some asked “who will pay”, “would people be willing to pay”, or “who will initially gain and who pay?” Some said it’s “expensive – goes on our energy bill.” Others felt that “the cost of the energy that needs to be used for it makes it less effective than BECCS and so less viable” or said they were “not sure if [it is] cost effective yet as new technology.”

⊖ Public support

One assembly member said it “can be done at scale (acknowledged) but [I] still don’t trust it.”

⊖ Safety and risk

Some assembly members said that “**storage of CO₂ is not a good idea**, worried about it escaping”, that they “wouldn’t feel confident that the carbon wouldn’t escape” or expressed concerns about the “risk of uncontrolled release of CO₂ for future generations.” Some asked “how safe is the storage?”, “how long can it be stored for?” or noted they were “concerned about storing carbon in the earth’s crust – what impact will it have?” Others raised concerns about the “safety of carbon transport”, or said they “feel hesitant about carbon capture technology in general (this and BECCS).”

Some assembly members expressed “concern about air suction, chemical processes, and mineral extraction – potential issues include safety, cost, jobs, how green.” Others listed “concerns about leakage and turning the water acidic”, “concern about unknown long-term impacts, e.g. air quality” or said we have “no idea of what the **environmental impacts** might be.”

⊖ Other

One assembly member said they felt DACCS was a “waste of time”, another that it “feels like the option of last resort. Use it to mop up the last bits of CO₂.” One assembly member said “we’ve got no information about the costs or about the quantity of CO₂ removed.”⁶

→ Conditions

Some assembly members noted conditions around direct air capture and carbon storage – points they felt would aid its implementation or that should be put in place. They suggested a need to:

→ Undertake research and development

Some assembly members said that “research and development [are] needed”, that we should “look at it, but [it] needs more research” or that they “will go for anything that will work, even if it’s a small benefit – but it needs to be tried and tested.” Others said they see “value in exploring and investing in it alongside other options”, that “everything is new and experimental at some stage” or that “investment must be increased.” Similarly some said “maybe with more R&D they will come up with an acceptable solution. They have to start somewhere.” Others said they see “potential for further development” or that it’s an “option for [the] future but not so much now.”

⁶ Assembly members heard evidence about the relative cost of the different methods. It was not possible to give them the more precise figures requested because there are a range of plausible costs for direct CO₂ removal methods. Methods also carry a variety of wider costs and benefits that hinder simple cost comparisons.



→ Only use it if it's proven and affordable

Some assembly members said they would support the idea "if the technology is there and proven", that if it's "proven to work and affordable then it's a great idea" or that "if the tech to make it go solid comes in then brilliant."

→ Manage costs

Some said they would be in favour "if the cost is not too high", while others said "if it doesn't show itself to be viable then we will have to stop spending money on it."

→ Use it in moderation only, or as a last resort (at least at first)

Some assembly members said it "should only be used in moderation as a way of capturing that last bit of carbon that can't be captured by a combination of natural methods of carbon storage and moves towards generating carbon neutral energy." Others said it should be a "last resort solution - if nothing else works" or "only an interim measure while still using fossil fuels and other technologies are being developed." Some commented that we "should be using natural approaches straight away as we know they will work and use these technologies in the background as over time we will understand them better, they will improve, cost may improve."

→ Use a mix of options, potentially prioritising natural ones

Some assembly members said “we shouldn’t shut down any option – there has to be a place for all options”, that we “need a balanced approach to capturing CO₂; can’t rely on just one option” or that it “could be OK, but don’t put all eggs in one basket, priority should be natural measures.” Other assembly members commented that they “still think natural approaches are best but not sure they can be enough, this and BECCS have so much larger scope in potential BUT we don’t know that they definitely work.”

→ Don’t let it distract from better solutions

Some assembly members warned to “[b]e careful that it doesn’t detract from other best practice approaches”, that “[i]f it is developed, it shouldn’t be an excuse to carry on using fossil fuels” or said that “[t]echnology is great, but humans need to start taking responsibility for our impact on our surroundings.”

Individual assembly members made additional comments including:

- “ Concerned about the carbon cost of setting this up and building the plant.”
- “ Companies should be required to capture the CO₂ they are responsible for generating, as long as it’s regulated properly. They should be mandated to do this. But, don’t want them to see this as a get out of jail free card and not do other things first. Will this mean a carbon trading scheme?”
- “ If it does work, be sensitive to where they are put and the impact on people.”
- “ Excess power to be used for this when it is available i.e. extra electricity generated by the different technologies (e.g. nuclear now and wind/solar in future) be directed towards CC when not able to be used elsewhere.”
- “ Can we join this with BECCS all in one place?”
- “ Needs to be beneficial in the long-term.”
- “ Need to be able to trust the scientists; we need to be sure they know what they are doing.”

One assembly member said we can’t store electricity, but can store synthetic fuel. They said they had called “a company in Canada using this approach” who said it “can be scaled, but is currently expensive.”

As seen in Section A, assembly members expressed limited support for direct air capture and carbon storage in their votes.

C. Cross-cutting considerations

After discussing each of the six greenhouse gas removal methods in turn, assembly members had the chance to reflect on the methods overall.

These notes and discussions didn't tend to raise new issues. However they did emphasise the following points as important to significant numbers of assembly members:

- **A preference for 'natural' solutions** – significant numbers of assembly members said they preferred the first four options, which they felt were more “natural.” Some also restated a variety of concerns about carbon storage;
- **The need for a combined approach** – one group of assembly members noted “general agreement that instead of looking at a single solution we need to combine solutions, as well as changing our lifestyles.” A significant number of individual assembly members made similar points, including:
 - “ Combination of all of them: no single silver bullet. All techniques should work together. I think these should all be part of the broad range of ways to reduce the carbon in the atmosphere.”
 - “ I feel that all 6 options should be used. The first 4 methods would be dependent on the geographics and should be options at a local level. The options which include capture and storage would be better at a national level.”
 - “ I think it has to be a combination of different methods on different scales rather than relying on one or two methods.”

A small number of assembly members commented more specifically on combining options involving trees and wood. For example:

- “ It would be a good idea to combine the tree-based options so it is completely efficient e.g. plant trees and then once they've matured we can cut them down for construction and once we need to take down the building we can use it as bioenergy and use BECCS.”
- **A wish to focus on reducing emissions, rather than capturing them afterwards** – for example, comments included:
 - “ Need to concentrate on reducing carbon at source rather than capturing it.”
 - “ The focus should be on producing less rather than offsetting.”
 - “ We can't just rely on removing carbon from the air we need to change how much we are putting in as well.”
 - “ I think pursuing the technology of carbon capture through CCS, could make gas emissions seem more solvable, therefore acceptable, when we should be really focusing on using nature, renewables, reduction and change.”



There was also a significant, although slightly lesser, number of comments about the **role that BECCS and DACCS could play**. For example:

- “ I like the natural solutions as far as possible. Then for the extra stuff we invest in the additional technologies. All of them will be needed.”
- “ I believe it is important to start with natural solutions which can start now and as technology matures in carbon capture and storage we then take advantage.”
- “ First two solutions – all for it but would like to see investment in the last two.”
- “ I believe we should adopt a blended approach at this stage and not depend on any specific solutions. When the CCS technology is more developed and cheaper we could employ more of this. Similar for direct air capture. All the approaches will require international co-operation and incentives to remove greenhouse gases.”

One assembly member raised an additional point, noting that CO₂ can be made into plastics and gravel, as well as synthetic fuels. They suggested that these options are also important for greenhouse gas removals.

Conclusions

Removing greenhouse gases from the atmosphere is a complex topic containing many uncertainties, and yet assembly members' conclusions are in many ways clear and striking.

Four greenhouse gas removal methods received significant support: **forests and better forest management (99%)**, **restoring and managing peatlands and wetlands, (85%)**, **using wood in construction (82%)** and, **to a lesser extent, enhancing the storage of carbon in the soil (62%)**.

These were the options that many assembly members felt were most “**natural**.” Assembly members also tended to see these options, particularly the first two, as **having significant co-benefits**. These included advantages around preventing flooding and erosion, increasing biodiversity, access to nature and enjoyment.

Assembly members said they would like the implementation of these methods to be planned and managed well – for example, planting the right trees in the right places, managing forests properly, and minimising risks around the use of wood in construction. They also suggested a need to **think about and support farmers**, particularly in relation to restoring and managing peatlands and wetlands and enhancing the storage of carbon in the soil. **Sustainability**, including an aversion to importing trees and wood also came up a number of times. For some assembly members, thinking about **the balance of land use** was important too.

The more technological or “man-made” options of **BECCS and DACCS** secured lower rates of approval and higher rates of disapproval. 42% of assembly members ‘agreed’ or ‘strongly agreed’ that each of BECCS and DACCS should be part of how the UK gets to net zero, while 36% (BECCS) and 39% (DACCS) ‘disagreed’ or ‘strongly disagreed’.

Many assembly members were worried about the risk of **leaks from carbon storage sites**. Many too felt that these options **failed to address the problem**. This was for a variety of reasons, including that they risked “tak[ing] the focus off the amount that we are emitting in the first place” and “kicking the can down the road.”

Assembly members also voiced concerns around the methods being **less natural**, their **costs**, and the **unproven nature of the technology**, particularly in relation to DACCS. They noted the **amount of energy used by DACCS** and suggested this might be counterproductive.

Whilst BECCS and DACCS therefore received limited support, some assembly members were keen that further research and development takes place, noting for example that these technologies could perhaps then be used more in the future or that they might be needed to “mop up” remaining CO₂.

In general, there was a feeling amongst assembly members that a combination of greenhouse gas removal methods would be needed.