

Environmental evidence base: Land use



- Air quality
- Biodiversity
- Geodiversity
- Landscape
- **Land use**
- Soils
- Water

ofgem

Overview

- Introduction:
 - A systematic review has been undertaken to characterise the impacts of the GB regulated energy system (primarily transmission and distribution) on the natural environment
 - There are seven issues that are seen to be important to address: Air quality, Biodiversity, Geodiversity, Landscape, Land use, Soils, and Water.
- Purpose of the evidence bases:
 - The intended use of the evidence bases is: to inform development of regulatory policy proposals, support internal/external advocacy, and support internal implementation of Ofgem’s strategic and sustainability assessment framework
 - This evidence base describes: the current state of land use in GB, wider pressures on land use in GB, and potential impacts from any pressure on land use, factors leading to such impacts and relevant statutory legislation/regulation
 - The evidence base provides an initial ranking of the impacts and also gives more detailed consideration to those individual elements of the GB regulated energy system likely to have greatest impact on land use and/or to arise most frequently
 - The evidence base identifies: how the significance of impacts may be affected by climate change, existing statutory legislation/regulation intended to prevent or minimise impacts, and management actions that prevent or minimise impacts and can be undertaken by a range of actors
- How to use:
 1. The environmental evidence bases should be used to identify the impacts associated with the policy/project using the matrix, ‘flag’ those that are high impact with high/medium confidence and those that are medium impact with high confidence requiring scrutiny / additional analysis.
 2. Undertake more detailed consideration of the significance of these impacts
 3. Undertake more detailed analysis of the interactions with climate change
 4. Consider potential prevention and mitigation measures
 5. Undertake additional qualitative and quantitative analysis, as required
- Case study:
 - A worked step-by-step case study has been included, considering the pressure on land use with the most significant impacts, in order to help you use this evidence base

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The state of land use

- Most of the UK's land area is in agricultural use, and how it is used is central to sustainable development. It thus demands protection from inappropriate development
- Land quality varies from place to place. In England and Wales, the [Agricultural Land Classification, ALC](#), classifies land into five grades, based on long-term physical limitations to agricultural use (climate, site, soil characteristics, and their interactions).
 - Land that is most flexible, productive, responsive to inputs and can best deliver future food and non-food crops is defined as Grades 1, 2 and 3a.
 - Grades 1 and 2 comprise about 21% of all farmland in England; Subgrade 3a also covers approximately 21%.
 - The ALC is employed within the planning system in England and Wales to inform decisions on future use.
- In contrast, only around 25% of Scotland's soils are cultivated, although most of the land is under some form of agricultural or forestry management. [The Macaulay Land Capability for Agriculture classification, LCA](#), is a seven class system with Class 1 having the highest potential flexibility of use.
 - The classification has been simplified into four categories, broadly indicative of agricultural capability: [Arable Agriculture \(LCA classes 1-3.1\)](#), [Mixed Agriculture \(LCA classes 3.2-4.2\)](#), [Improved Grassland \(LCA class 5.1-5.3\)](#), and [Rough Grazing \(LCA classes 6.1-7\)](#).
 - The LCA is widely used in Scotland by agriculturalists, planners, estate agents and others.

- The GB regulated energy system contributes to wider pressures on land use.
- In 2010, the Government Office for Science published [Land Use Futures](#), which identified six major factors driving land-use change in the UK over the next 50 years:
 - **Demographic change**; the population is set to increase by c.15 million, particularly in the Southeast, increasing demands for land for housing, transport, water, food and recreation, as well as energy
 - **Economic growth and changing global economic conditions**, implying increasing demand for land, exacerbated by concerns about food security, which may increase pressures for domestic supplies
 - **Climate change**; in addition to increasing demands on land from renewable energy for climate change mitigation, adapting to climate change may include reducing development on flood plains
 - **New technologies** may not only alter land use by promoting changes to energy provision but also by encouraging sustainable agricultural intensification, and changing commuting patterns due to ICT
 - **Societal preferences and attitudes** leading to conflicting desires for land use and policy responses
 - **The policy and regulatory environment**, which could profoundly affect how effectively land is used.

Potential impacts on land use

- The following slides:
 - Identify and broadly categorise potential impacts arising from any pressure on land use
 - Identify factors that lead to such impacts
 - Highlight relevant statutory legislation or regulation intended to prevent or minimise such impacts
- This information is then used specifically to consider impacts on land use arising from individual elements of the GB regulated energy system.

For more information on roles and responsibilities of regulators for land use, please refer to Annex 1.

For more information on relevant legislation, please refer to Annex 2

Potential impacts on land use

Impact	Factor	Relevant legislation
Land-cover change	Changes in land cover, e.g. loss of agricultural or forestry land to development	<ul style="list-style-type: none"> • The natural environment white paper • Natural environment framework – a living Wales
Land-use change	Factors that alter the physical environment (e.g. soil, hydrology) and thereby land-use	<ul style="list-style-type: none"> • Environmental impact assessment directive • Strategic environmental assessment directive
Fragmentation of land management units	Impacts on the area, isolation and edges of management units that impinge on landowners' abilities to achieve their objectives, including: <ul style="list-style-type: none"> • Physical sub-division of management units • Physical barriers to access • Limitations imposed by developments on adjacent land 	<ul style="list-style-type: none"> • Rural development programme • Wales spatial plan
Restrictions on land management	Factors that place constraints on: <ul style="list-style-type: none"> • Use of machinery • Tree growth 	<ul style="list-style-type: none"> • National planning policy framework • Getting the best from our land – a land use strategy for Scotland • Scottish planning policy • National planning framework • Planning policy Wales

Potential impacts on land use

Impact	Factor	Relevant legislation
Chemical effects	Release of chemicals that affect land use, as a result of processes such as: <ul style="list-style-type: none">• Acidification (deposition of chemicals that make soils more acid)• Eutrophication (an increase in nutrients, usually compounds containing nitrogen)• Toxic pollution (chemicals which immediately poison, or accumulate in the environment)	<ul style="list-style-type: none">• Good agricultural and environmental condition (GAEC) standards
Loss of crops	Factors that lead to physical damage or loss of crops	<ul style="list-style-type: none">• Single farm payment scheme
Indirect land-use change	Direct impacts on land use that have knock on implications for land use elsewhere, most likely within individual land holdings	

Instructions

- Case Study:
 - The steps are illustrated using a ‘real-life’ case study.
 - This considers the pressure “Electricity storage – hydro”
 - Steps 2 to 5 have been applied to this case study. For general use, you will need to tailor these steps to your own policy/project
- Step 1: Initial rankings of impacts
 - This step applies to all policies/projects
 - The matrices illustrate the severity of each pressure on the various impacts and so can be used to highlight areas for additional scrutiny
- Step 2: Significance of rankings
 - In this step you develop a matrix specific to your given policy/project
 - This allows you to consider the significance of the identified impacts
- Step 3: Interactions with climate change
 - Another case-specific matrix is developed here analysing the interactions with climate change
- Step 4: Preventing or minimising the impacts
 - A final case-specific matrix is developed in order to consider potential prevention and mitigation measures
- Step 5: Qualitative/quantitative analysis
 - Within your policy/project development, you should undertake further analysis of the relevant impacts and mitigation measures

Step 1: Initial ranking of impacts on land use

- Having identified and broadly categorised potential impacts arising from any pressure on land use, the following tables provide an expert initial ranking of each of the individual elements of the GB regulated energy system:
 - Independent of other energy system-environment interactions
 - At the likely scale of an individual pressure (e.g. an individual transmission line or sub-station)
 - Irrespective of existing statutory legislation and regulation, and
 - Irrespective of potential timing
- Cumulative effects are considered in the same way in relation to each individual element of the GB regulated energy system
- The matrices should be used to ‘flag up’ significant impacts. This will allow you to conduct further investigation on those significant impacts, for which we have a high degree of confidence in the evidence available

- Impact is defined as:



High: national, permanent, irreversible

Medium: regional, semi-permanent, difficult to reverse

Low: local, temporary, reversible

- Confidence in evidence of such impacts is defined as:

H
M
L

High: robust evidence, high agreement

Medium: medium evidence, medium agreement

Low: limited evidence, low agreement

Initial ranking of impacts on land use (electricity transmission)

Driver: Electricity transmission	Impact							
Issue: Land use	Land-cover change	Land-use change	Fragmentation of land management units	Restrictions on land management	Chemical effects	Loss of crops	Indirect land-use change	Cumulative effects
Pressures								
New transmission lines – Overhead	H	H	M	H	L	M	L	M
New transmission lines – underground	H	H	L	H	L	M	L	M
New distribution lines	H	H	M	H	L	M	L	M
New/extended substations	H	H	L	M	L	H	L	M
New marine interconnection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Marine interconnection – land base connection	H	H	M	H	L	M	L	M
Marine sub-sea lines	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Marine sub-stations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Series compensation installations	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Electricity storage – hydro*	H	H	H	H	L	H	L	L
Electricity storage – compressed air	N/A	L	L	L	L	L	N/A	N/A
Electricity storage – batteries	L	L	L	L	L	L	N/A	N/A
Electricity storage – cryogenic systems	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Smart grids	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*This is the pressure addressed in the case study

Initial ranking of impacts on land use (gas transmission)

Context

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Driver: Gas transmission	Impact							
Issue: Land use	Land-cover change	Land-use change	Fragmentation of land management units	Restrictions on land management	Chemical effects	Loss of crops	Indirect land-use change	Cumulative effects
Pressures								
New gas transmission network	H	H	H	H	L	H	M	M
New compressors	H	H	N/A	H	L	H	N/A	H
New distribution network	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
New port infrastructure – gas reception facilities	H	H	H	H	L	H	M	H
New port infrastructure – LNG import	H	H	H	H	L	H	M	H
Marine interconnection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biogas upgrading for injection to grid	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gas storage – underground storage in caverns or gas and oil fields.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Gas storage – above ground connection	L	L	L	L	L	L	N/A	L
CCGT – district heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Biomethane injection to grid	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Shale gas – connection to grid	H	H	H	H	L	H	M	M

Initial ranking of impacts on land use (carbon capture and storage)

Driver: CCS	Impact							
Issue: Land use	Land-cover change	Land-use change	Fragmentation of land management units	Restrictions on land management	Chemical effects	Loss of crops	Indirect land-use change	Cumulative effects
Pressures								
Redeployment of gas pipelines for CO ₂	N/A	N/A	N/A	N/A	N/A	L	N/A	N/A
New CO ₂ pipelines	H	H	H	H	L	H	M	M
CCS process	N/A	N/A	N/A	N/A	L	N/A	N/A	L

Case study – Electricity storage hydro

Context

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The pressures with the most significant impacts, identified in the previous matrix are:

- Electricity storage - hydro

The case study hence considers an example of those pressures.

Scottish and Southern Energy has submitted an application to the Scottish Government for consent to construct the Coire Glas pumped storage hydro-electric scheme at Loch Lochy. It would be the largest hydro project built in Scotland and requires construction of one of the biggest dams in the UK, an upper reservoir, an underground powerhouse complex, and an outlet area with associated buildings and structures.

Planning is governed by The Electricity Act 1989 (Requirement of Consent for Hydroelectric Generating Stations (Scotland) Order 1990). The Highland Structure Plan (2001) and West Highlands and Islands Local Plan (2010) set out regional planning policy; power of consent lies with the Scottish Ministers. Planning approval, required from the Highland Council, has been granted despite opposition.

The Scottish Ministers' Scoping Opinion identifies issues needing to be addressed by the Environmental Impact assessment, including potential impacts on land use. These have been assessed. It is likely that the development will lead to temporary loss of woodland and forestry, moorland and agricultural land. Measures have been suggested to reduce impacts, as required.



Loch Lochy

Site of proposed services and outlet for the Coire Glas Pumped Storage Scheme

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Reference

Scottish and Southern Energy: Coire Glas Hydro Scheme
<http://www.sse.com/CoireGlas/ProjectInformation/>

Step 2: Significance of impacts on land use

- Now you will need to undertake further analysis, which is illustrated here utilising the case study on the previous slide
- The following tables go on to provide more detailed consideration of the significance of impacts from those individual elements of the GB regulated energy system initially ranked highest and/or that are likely to arise most frequently
- To do this you use a case-specific matrix. An example is shown on the next slide.
 - This allows you to see which impacts should be given priority in your analysis
 - In this case, land cover change, land use change, fragmentation of land management units, restrictions on land management, loss of crops and indirect land use change are the main impacts to be considered
- Ranking of magnitude is based on extent, duration, reversibility and frequency of impact
- Confidence in the evidence is defined in the same way as for the initial ranking

- A combined ranking of the significance of impacts is based on magnitude x confidence:

Magnitude	High	Yellow	Red	Red
	Medium	Green	Yellow	Red
	Low	Green	Green	Yellow
		Low	Medium	High
		Confidence		

- Significance:

Red	High
Yellow	Medium
Green	Low

Significance of impacts on land use

Issue: Land use	Impact							
	Land-cover change	Land-use change	Fragmentation of land management units	Restrictions on land management	Chemical effects	Loss of crops	Indirect land-use change	Cumulative effects
Pressure: Electricity storage – hydro								
Positive or negative	-	-	-	-	-	-	-	-
Extent	Local	Local	Local	Local	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent	Permanent
Reversibility	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse
Frequency	Construction and Operation	Construction and Operation	Construction and Operation	Construction and Operation	Construction and Operation	Construction and Operation	Construction and Operation	Construction and operation
Magnitude	High	High	High	High	Low	High	High	Medium
Confidence	High	High	Medium	Medium	Medium	Medium	Medium	Medium
Significance	High	High	High	High	Low	High	High	Medium

References

Wänn, A. *et al.* (2012) Environmental performance of existing energy storage Installations. World Congress on Water, Climate and Energy, Dublin. International Water Association.

http://keynote.conference-services.net/resources/444/2653/pdf/IWAWCE2012_0212.pdf.

Step 3: Interactions with climate change

- Having provided more detailed consideration of the significance of impacts from those individual elements of the GB regulated energy system initially ranked highest and/or that are likely to arise most frequently, the evidence base goes on to review their potential interactions with climate change.
- This is done through developing another case-specific matrix
 - This allows you to see how the impacts of your policy/project relate to climate change and whether they are going to be amplified, remain neutral or reduce with climate change
 - In the case that is being considered here, it is shown in the matrix on the next slide that climate change is likely to amplify the land use impacts
- The following tables identify how the significance of impacts may change as a result of:
 - Direct impacts of climate change on land use
 - Climate change adaptation actions identified by key energy infrastructure providers under the Climate Change Act 2008 adaptation reporting power

Interactions with climate change

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Issue: Land use	Impact							
Pressure: Electricity storage – hydro	Land-cover change	Land-use change	Fragmentation of land management units	Restrictions on land management	Chemical effects	Loss of crops	Indirect land-use change	Cumulative effects
Significance	High	High	High	High	Low	High	High	Medium
Climate change	=	=	=	>	>	>	>	=

Reference

- Adaptation Reporting Power received reports (2012) Adaptation plan reports: electricity distributors and transmitters and gas transporters.
<https://www.gov.uk/government/publications/adaptation-reporting-power-received-reports>

Step 4: Preventing or minimising the impacts

- Finally, the evidence base considers prevention of impacts from those individual elements of the GB regulated energy system initially ranked highest and/or that are likely to arise most frequently, and whose significance and interactions with climate change have been reviewed
- The following tables identify:
 - Relevant existing legislation or regulation
 - Management actions that prevent or minimise impacts and can be undertaken by a range of actors
- The prevention and mitigation measures should be considered in any analysis undertaken in your policy/project development

Preventing or minimising the impacts

Context

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Issue: Land use	Impact							
	Land-cover change	Land-use change	Fragmentation of land management units	Restrictions on land management	Chemical effects	Loss of crops	Indirect land-use change	Cumulative effects
Pressure: Electricity storage - hydro								
Significance	High	High	High	High	Low	High	High	Medium
Legislation/regulation	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	6, 7
Management	Use of existing reservoirs	Use of existing reservoirs	Use of existing reservoirs	Use of existing reservoirs	Timing and location of water releases	Use of existing reservoirs	Use of existing reservoirs	

References

1. National Planning Policy Framework – England (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf)
2. Scottish Planning Policy (<http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/newSPP>)
3. National Planning Framework (<http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/npf>)
4. Planning Policy Wales (<http://wales.gov.uk/topics/planning/policy/ppw/?lang=en>)
5. The Electricity Act 1989 (Requirement of Consent for Hydro-electric Generating Stations) (Scotland) Revocation Order 2011 (<http://www.legislation.gov.uk/ssi/2011/115/made>)
6. Environmental Impact Assessment (EIA) Directive (<http://ec.europa.eu/environment/eia/eia-legalcontext.htm>)
7. Strategic Environmental Assessment (SEA) Directive (<http://ec.europa.eu/environment/eia/sea-legalcontext.htm>)

Step 5: Qualitative/Quantitative Analysis

- After using the matrices to identify relevant impacts for your policy/project, identifying their significance, considering their interactions with climate change and potential prevention and mitigation measures, you should undertake further analysis to feed into any Impact Assessment being developed
- The analysis can be either qualitative or quantitative (if available)
- For the case study we are considering, further analysis should be given to the following impacts:
 - Land cover change
 - Land use change
 - Fragmentation of land management units
 - Restrictions on land management
 - Loss of crops
 - Indirect land use change

Conclusions

- Individual elements of the GB regulated energy system likely to have the greatest impact on land use and/or to arise most frequently are:
 - New overhead and underground transmission lines
 - New distribution lines
 - New/extended substations
 - Electricity storage hydro
 - New gas transmission network
 - New compressors
 - New port infrastructure – gas reception facilities, and liquid natural gas (LNG) import
 - Shale gas connection to the grid
 - New CO₂ pipelines for carbon capture and storage
- Their most significant potential impacts relate to:
 - Land-cover and land-use change
 - Restrictions on land management
 - Fragmentation of land management units
 - Loss of crops
 - Indirect land-use change
- Climate change is likely to amplify many of these impacts.
- Existing statutory legislation or regulation preventing or minimising such impacts includes:
 - Environmental Impact Assessment (EIA) Directive (<http://ec.europa.eu/environment/eia/eia-legalcontext.htm>)
 - Strategic Environmental Assessment (SEA) Directive (<http://ec.europa.eu/environment/eia/sea-legalcontext.htm>)
 - National Planning Policy Framework – England (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf)
 - Scottish Planning Policy (<http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/newSPP>)
 - National Planning Framework (<http://www.scotland.gov.uk/Topics/Built-Environment/planning/National-Planning-Policy/npf>)
 - Planning Policy Wales (<http://wales.gov.uk/topics/planning/policy/ppw/?lang=en>)

Annexes

- Development of national planning policy guidance is devolved to a country level. Responsibility resides with the Department for Communities and Local Government (in England), the Welsh Government and the Scottish Government.
- Most land-use planning decisions are made by local planning authorities.

Relevant legislation and regulation

The statutory legislation and regulations identified here provide the legal framework in relation to land use.

Europe

- [Environmental Impact Assessment \(EIA\) Directive](#): an EIA is mandatory for all projects listed in Annex I, which includes projects relevant to the UK regulated energy system
- [Strategic Environmental Assessment \(SEA\) Directive](#): SEA is mandatory for public plans, programmes and strategies that set the framework for future development consent of projects listed in the EIA Directive or that require an SEA under the [Habitats Directive](#)

England

- [The Natural Environment White Paper](#)
- [National Planning Policy Framework \(England\)](#)
- [Single Farm Payment Scheme](#)
- [Good Agricultural and Environmental Condition \(GAEC\) standards](#)
- [Rural Development Programme](#)

Relevant legislation and regulation

Scotland

- [Getting the best from our land – A land use strategy for Scotland](#)
- [Scottish Planning Policy](#)
- [National Planning Framework](#)
- [Single Farm Payment Scheme](#)
- [Good Agricultural and Environmental Condition \(GAEC\) standards](#)
- [Rural Development Programme](#)

Wales

- [Natural environment framework – a living Wales](#)
- [Planning Policy Wales](#)
- [Wales Spatial Plan](#)
- [Single Farm Payment Scheme](#)
- [Good Agricultural and Environmental Condition \(GAEC\) standards](#)
- [Rural Development Programme](#)

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